SCIENTIFIC AMERICAN

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THE LATEST LONG DISTANCE TELEPHONE TRANSMITTER.

Early in the history of the telephone, after it had been before that great tribunal, the public, the verdict seemed to be that it might answer for local purposes, but much improvement would be required before it could be used for long distance communication. In the telephone, as in everything that comes "to stay," the required improvements have been gradually developed, so that at the present time, instead of communicating telephonically over even short distances with great difficulty and uncertainty, it is now as possible and practicable to carry on conversation over a line 200, 500 or 1,000 miles long as to converse face to face. Now New Yorkers can readily converse over the wires with Philadelphia, Baltimore, Washington, Chicago, Milwaukee, and other distant places, and wherever the long distance telephone is in use, not only does the user have the advantage of communicating over distances up to 1,000 or 1,500 miles, but he is sure of very superior local service.

These results are due mainly to the metallic circuit and the long distance transmitter, the receiver remaining practically the same as it was at first.

The long distance transmitter is fully illustrated by the accompanying engravings, and forms the subject of this article.

Into the ring forming the front of the diaphragm case is screwed the mouthpiece, and in a circular recess in the back of the ring is placed the sheet iron diaphragm having a binding of soft rubber around its edge, as shown in Fig. 8, and between the diaphragm and the cell is inserted the mica ring shown in Fig. 7. To the rear surface of the front of the diaphragm case is secured an offset bar, in the center of which, at a point opposite the center of the diaphragm, is inserted the shank of a metallic cell containing the electrodes. In the bottom or rear portion of the cell is placed a disk of dense carbon, the face of which is highly polished. To the front of the cell is clamped a disk of mica by means of a ring screwed on the cell and furnished with a fillet. In an aperture in the center of the disk of mica is inserted the shank of a button, the inner surface of which is covered by a disk of highly polished dense carbon. The space between the button and the rear carbon disk is filled with granules of carbon, and the shank of the button extends through the central aperture of the diaphragm and is held therein by a nut and a jam nut.

The diaphragm is held in its place in the case and damped by a spring (see Fig. 6) secured to the case and covered at its free end with soft rubber. The carbon cell is adjusted by moving it out or in until the required pressure is secured, when the shank of the cell is clamped. The cell is shown in detail in Fig. 10, the polished carbon button in Fig. 11, the front button connected with the diaphragm in Fig. 13, the mica disk in Fig. 14, the nut by which it is clamped to the button in Fig. 15, and the ring which screws on the cell and holds all the parts in place is shown in Fig. 16.

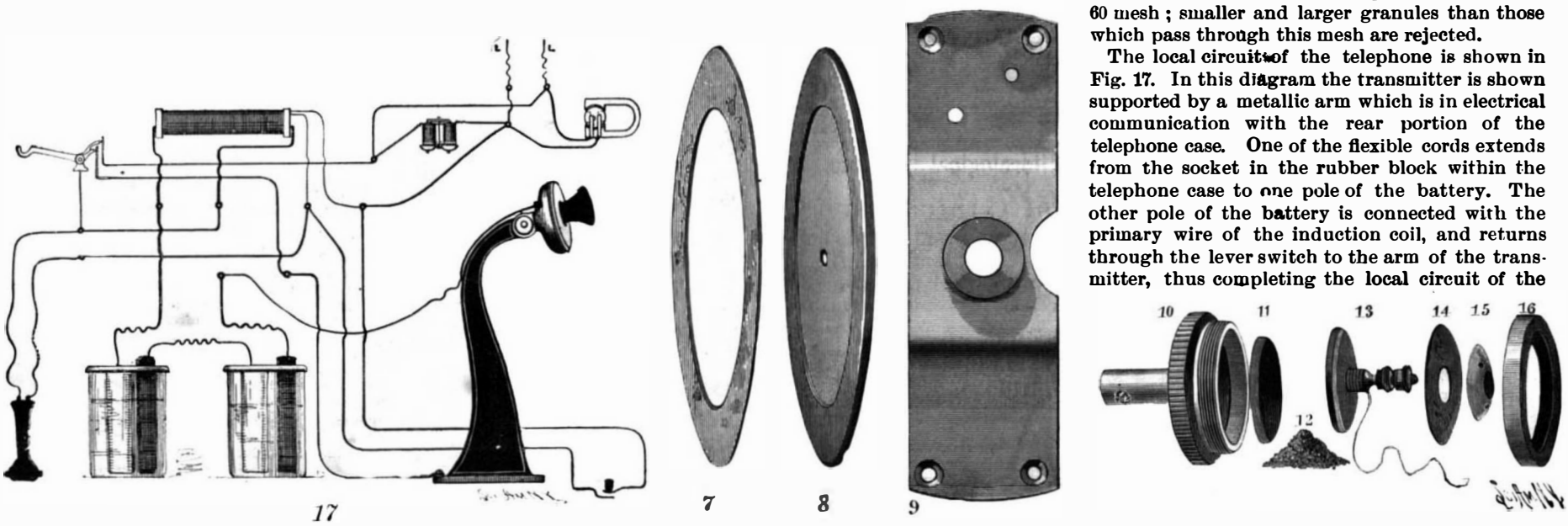
To the back of the bar extending across the cell is secured an insulating block of hard rubber into which is screwed the socket, shown in Fig. 5, for receiving the end of a flexible cord. The arm attached to the socket is connected with the metallic button carrying the outer carbon. The form of the insulating block of rubber is shown clearly in Figs. 2 and 3. The back of the diaphragm cell consists of a metal cup (Fig. 1) attached to the front plate by screws. The cup forms a metallic contact with the carbon cell and is connected electrically with one of the battery wires.

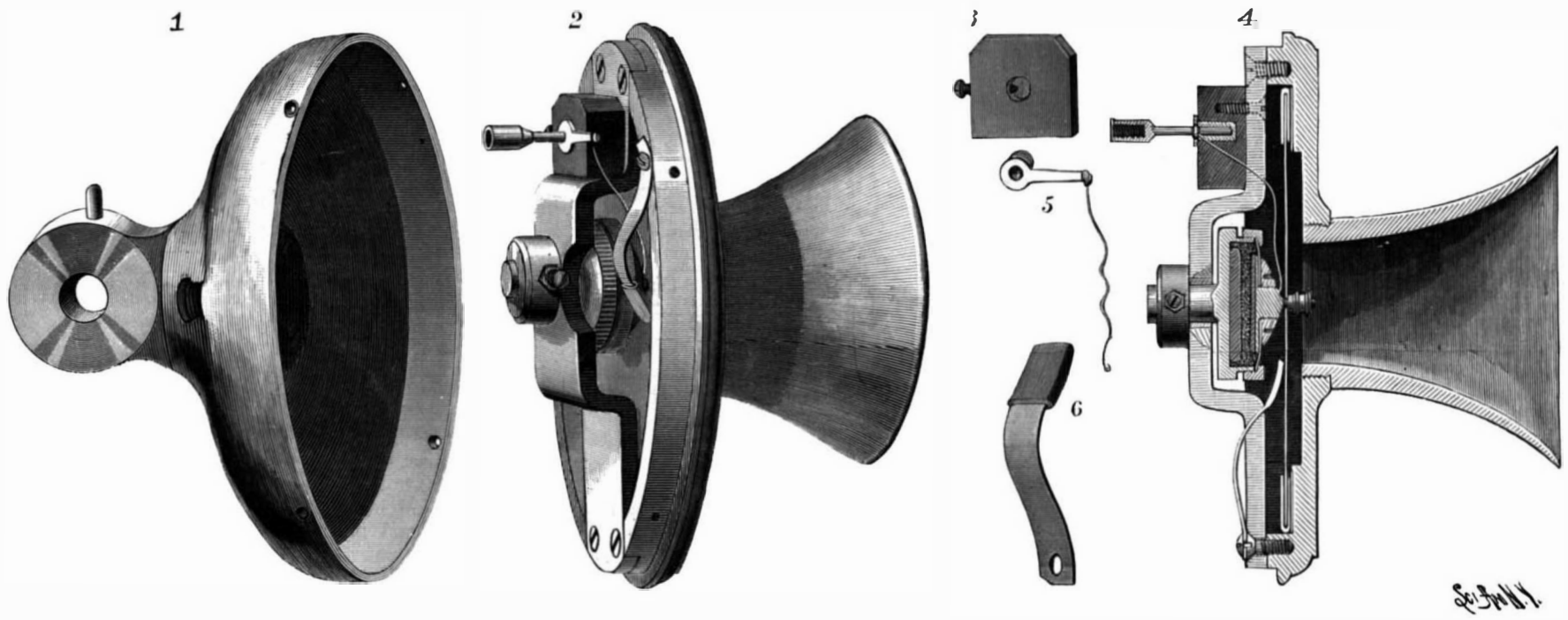
The granulated carbon used in the cell is made by one of the gunpowder manufacturing companies, and the secret of its manufacture is not known to the public, but it has been ascertained that coked Schuylkill anthracite coal will answer the same purpose. The carbon granules are screened through a wire sieve of 60 mesh; smaller and larger granules than those which pass through this mesh are rejected.

The local circuit of the telephone is shown in Fig. 17. In this diagram the transmitter is shown supported by a metallic arm which is in electrical communication with the rear portion of the telephone case. One of the flexible cords extends from the socket in the rubber block within the telephone case to one pole of the battery. The other pole of the battery is connected with the primary wire of the induction coil, and returns through the lever switch to the arm of the transmitter, thus completing the local circuit of the telephone. One of the line wires is connected with one terminal of the induction coil, the other terminal of the induction coil is connected directly with the telephone receiver, which in turn is connected with the lever switch, the latter being in electrical connection with the other line wire. Two wires connected with the secondary terminals run to a cut-out key at the right of the transmitter. It is found advantageous to short-circuit the induction coil by pressing this key while the message is being received, as it cuts out the resistance of the coil and also that of the call bell.

The induction coil has a half inch core of soft iron wires on which are wound three layers of No. 16 wire (A. W. G.), and upon this is wound the secondary wire, which consists of No. 23 (A. W. G.), a sufficient quantity being used to make the resistance of the secondary about 17 ohms. The length of the coil between the flanges of the spool on which it is wound is 6 inches.

(Continued on page 107.)





1 and 2. Back and front portions of transmitter. 3. Insulating block. 4. Diametrical section of transmitter. 5. Socket and arm for flexible cord end. 6. Damping spring. 7. Mica ring. 8. Iron diaphragm, with soft rubber binding. 9. Cross bar. 10. Carbon cell. 11. Carbon button. 12. Granulated carbon. 13. Carbon-lined front button. 14. Mica disk. 15. Nut. 16. Clamping ring. 17. Local circuit.

THE "SOLID BACK" LONG DISTANCE TELEPHONE TRANSMITTER.

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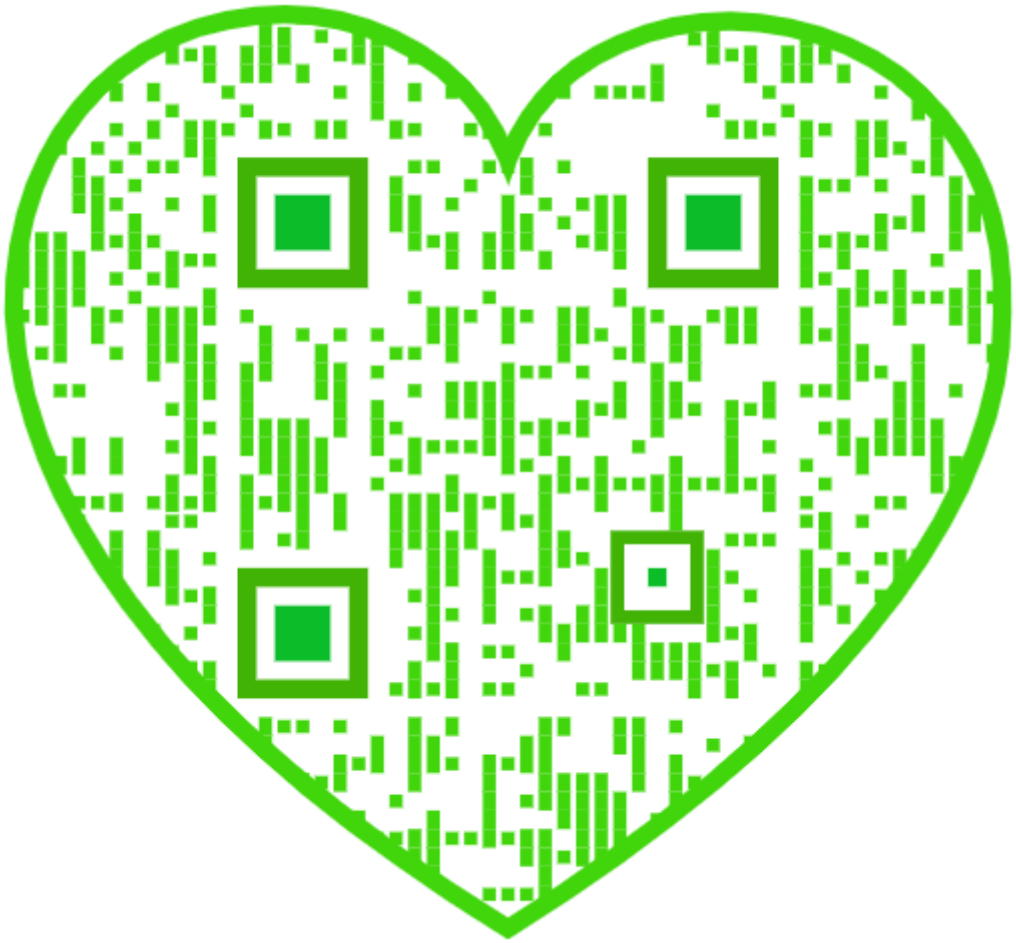

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ZERO WEATHER OVER THE UNITED STATES.

Such a drop in temperature as was experienced over the greater portion of the United States, from the Rocky Mountains to the Atlantic, and from the Canada border to the Gulf of Mexico, during the week ending February 9, has hardly had a parallel since the recording of weather changes has become a regular system. Severer weather and heavier snowfalls have been experienced heretofore in limited sections, but the great area and low range of temperature of the storm which had its center in Texas on February 6 was something phenomenal. The temperature was below the freezing point for nearly three days throughout the entire United States, except a small area on the southern extremity of Florida and the California coast up to about Portland. And within the lines which marked the extent of country over which a freezing temperature was being experienced the mercury dropped to the zero point over the greater portion. At New York City, three degrees below zero was experienced, and throughout New England the range was from zero to twenty-six degrees below. It was below the zero temperature also throughout the States of New York and Pennsylvania, in portions of Maryland, Virginia, and the Carolinas, and in the greater part of Georgia, Alabama, and Mississippi, the zero line extending down into the heart of Texas, and thence westerly to the Rocky Mountains, and including the entire territory of the Mississippi Valley and around the great lakes.

In the memorable blizzard of 1888, a much smaller area was affected, the storm being confined mainly to the Middle Atlantic States, and the temperature did not fall so low, although there was a much greater snow fall. The snow fall accompanying the last great cold wave has varied from a few inches in depth, along the coast, to upward of two feet at many points in the interior, and, accompanied as it has been by a high wind, reaching a velocity of seventy miles an hour at Sandy Hook, railroad travel in all directions has been greatly impeded. But perhaps the greatest loss attributable to the cold weather will be that of the Southern fruit crops. The zero point has been reached over a large territory where a freezing temperature has heretofore been but rarely experienced, and the fruit crops of these milder climates cannot but be an almost total loss, it being reported that the Florida orange crop and a great portion of the trees have been entirely destroyed.

A NEW JET-PROPELLED STEAM LIFEBOAT.

The Royal Lifeboat Institution, a benevolent organization supported by subscriptions from the charitable people of Great Britain, maintains many lifeboat stations on the coasts, which are the means of saving hundreds of lives every year. In general, lifeboats are worked by oars and sails. In 1891 the institution caused to be built a steam-propelled lifeboat, worked on the jet principle. That is to say, instead of the ordinary screw propeller, jets of water are used to drive the vessel.

The water jets are produced by means of rotary pumps, and when the jets are discharged from the stern the boat is driven forward. The discharge nozzles are capable of being shifted, so as to direct the jets laterally, in which case the vessel may be turned around or made to move sidewise. The first jet propelled lifeboat proved very useful and successful, and now the institution has added another boat, worked on the same principle. This vessel is named the City of Glasgow. She is 53 feet long, 16 feet beam, 5½ feet deep. Displacement 30 tons. Besides coal, provisions, water and crew, the boat will carry 40 passengers. On each side there are two centrifugal pumps for working the vessel. Engines, 200 horse power. Speed, 8 miles per hour, and capable of towing another boat at same speed. The vessel is propelled and turned with the utmost facility, without the use of the rudder, although, of course, a rudder is provided. Going at full speed the boat may be stopped dead and started astern in 20 seconds.

A somewhat similar jet boat, named the President Van Heel, has been built for the Lifeboat Institution of South Holland, and is operated with much success.

We have on several occasions called the attention of the Navy Department to the importance of having our war vessels fitted with jet pipes and proper connections with the steam pumps, so that in case of need, such as loss of rudder or in an action, this auxiliary means might be employed to steer, swing, or turn the vessel, as circumstances might require. We have also suggested the inquiry whether additional pumps and pipes might not be arranged for connection with the main engines of the ship, so that in case of loss of propeller, or breaking of shaft, the propulsion of the vessel might be still maintained.

These suggestions apply not only to war ships, but also to merchant steamers. The jet system is not capable of yielding so high a rate of speed for a ship as the propeller, but it is a safe and effective method, especially useful for emergencies. It would be a simple and comparatively inexpensive matter on all steamers to arrange jet pipes for steering purposes in case of rudder loss. Such devices should be made compulsory, same as other safety requirements

Charles W. Copeland.

Charles W. Copeland, one of the best known marine and mechanical engineers in the country, died at his Brooklyn home February 5. Mr. Copeland was born in Coventry, Conn., in 1815. Daniel Copeland, his father, was a builder of steam engines and boilers in Hartford, Conn. The plant was established on the premises afterward occupied by the extensive concern of the Woodruff & Beach Iron Works of that city. Charles Copeland was carefully trained by his father in designing and draughting steam vessels. He also received practical instructions in the shops in pattern making, founding, machine fitting, boiler making, and later became the superintendent of his father's establishment. He designed at this time a number of steamers for use on the Connecticut and Southern rivers. Under the guidance of Professor Hackley, of Columbia College, he became an adept in mathematics. In 1836 he accepted a position as designing and constructing engineer in the West Point Foundry of New York, then one of the largest plants of the kind in the country. While connected with this concern he designed and built many marine engines, including those for the United States naval steamer Fulton, the steamboats Utica, Rochester, Swallow, Milwaukee, and Cleveland, and the ferryboats Gold Hunter, Jamaica, Bunker Hill, and Lexington. He built the first iron hull in the United States for a boat which was put in service on Lake Pontchartrain.

In the year 1839 he was appointed constructing engineer to the United States navy, an office similar to that now occupied by the chief of the Bureau of Steam Engineering. During the Mexican war he fitted out what was called the "Mosquito Fleet," consisting of the Spitfire, Scorpion, Scourge, Vixen, etc. At a later period he designed the engines and boilers of the naval steamers Missouri, Mississippi, and the Michigan, for Lake Erie, which was the first iron steamer ever used for naval service. Subsequently he designed the machinery for the naval steamers Saranac and Susquehanna. He then became superintending engineer of the Allaire Works of New York, where he designed and built the machinery for the steamers Pacific and Baltic of the Collins Line, the Panama, the Bay State, the Empire State, the Traveler, and others. In 1852 Mr. Copeland's opinion was called for on the "Steamboat Bill," and he was appointed the first supervising inspector under the new law for the New York district. He held this position for nine years. During the civil war he was engaged in altering and refitting vessels for the Southern rivers, and he introduced double-enders for navigating the intricate channels of the rivers. Since the war, Mr. Copeland has been engaged as consulting and superintending engineer for United States Lighthouse Board and by private individuals and corporations. He designed the steamers City of New York, City of Worcester, and City of Boston during this period. These are only a few of the many works which came under Mr. Copeland's care. He was a man of the strictest integrity, and his reports were always models of accuracy and reliability.

A Water Pipe Trouble.

The way in which pipes sometimes become mysteriously clogged is illustrated by the following from the Sanitary Plumber:

"Arriving at the dwelling containing the troublesome closet, I went in and uncoupled the supply coupling at the valve, and with the water off blowed through the pipe. Judging from the ease with which the air passed through the pipe, it seemed that the supply was not at fault, and the plumber assured me that he had blown through it himself, long before. Nevertheless, I produced a small pocket mirror and directed a light to the interior of the coupling and pipe; there in an instant's glance I detected the cause of the failure. In making the joint which joined the valve coupling to the supply pipe, solder had run through and half filled the bore of the pipe. As the couplings for these valves are large, this would not ordinarily have caused the great reduction in the supply experienced in this case. The bulk of the solder which had run through hung free in the shape of a large lima bean. At the coupling end of the bean it was effectually hinged to the solder of the joint where it run through. One could blow through the pipe easily from the coupling end, but scarcely at all from the supply side, as the air or water would catch the solder bean and throw it across the waterway of the pipe, stopping its egress almost as effectually as would the clack of a check valve put on wrong side to.

"We pinched the solder out of the pipe and the closet worked charmingly. The plumber and his boss looked very crestfallen when the cause of the trouble became known, and did all they could to make amends."

THE Book of Job, written about 1520 B.C., describes very accurately several processes of smelting different metals.

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India Rubber.

At a recent meeting of the London section of the Society of Chemical Industry, Mr. T. Christy exhibited specimens of different sorts of rubber, specially with the view of showing that rubber can be extracted by water. In the first instance the Landolphia was shown with the roots and boughs as cut from the living tree, next the stems after they had been boiled. The next stage was the debris of the bark and the rubber still hanging on to one end of a twig which otherwise was perfectly clean and free from any succus; then there was the mass as it fell into the pan with the bark mixed with the gum. It was then shown in different stages of treatment up to the Landolphia rubber as sent into commerce. Another Landolphia was shown from the Congo; this had been wound off direct from the tree into a ball and dried in the course of winding.

Another exhibit was Almadina, so called from the man who discovered it and worked it out in West Africa; it also goes by the name of potato gum. This gum has most interesting properties, which have been fully explained in the scientific papers, especially by Mr. Lascelles Scott. From a series of experiments lasting over four years, it was found that by placing in a box, open to the sun and rain, some of the very best India rubber and gutta percha, some pure Almadina, and also Almadina mixed with India rubber and gutta percha, at the end of the experiment the best rubber had almost disappeared and was quite worthless, whereas the India rubber and gutta percha mixed with Almadina remained perfectly sound and with full elastic properties. He obtained some tons of Almadina, melted it, and added to it a considerable quantity of water and some tannic acid. This was well stirred and it took up a large quantity of water. When the mass was sufficiently kneaded it was put into bags and allowed to cool, and then sent down to some large India rubber works, and the proprietor was so pleased with it that he offered to take any quantity at 1s. 6d. to 1s. 10d. per pound. This rubber, of course, had a quantity of water in it; allowance had to be made in charging the weight when it was handed to the railway of at least 20 per cent. As practical manufacturers on a large scale had now admitted its great value, he then met them and told them that he could no longer continue to manufacture this gum, and that he was prepared, if they gave him a sufficient order for the raw material, to give them all the information. Suffice it to say that they gave the order, but the foreman resented it very much and did all he could not to use this rubber, until his place was handed over to another man who thoroughly understood the valuable properties of Almadina. The consequence was that a very much higher class of goods was turned out of these works and large contracts made. This shows how difficult it is to overcome prejudices.

Another gum, also obtained by being boiled, was chicle gum. This came from Mexico, and was known to Americans as the base for their chewing gum. Small pieces were prepared for those who desired to experiment with it. He had sent a sample to one of his friends, who was certainly one of the most advanced men in the rubber trade, and explained to him the most simple manner of testing it, viz., chewing it; he did so, and he wrote back saying that he was delighted with the material and wanted a quantity for experiment, and, if it went down to a certain price, to put his name down for the first supplies. This gum was also found useful in plaster making and pills.

In conclusion, there were many other gums which he believed would advantageously yield to the treatment of cutting down the boughs and boiling them in water, finally extracting the rubber as the mass cooled. He had sent a request to several places where the rubber trees were growing wild, suggesting that this plan should be tried.

The Future of the Earth and of Man.

One of the most immediate effects of the progress of sidereal evolution is the impoverishment of the fluid reservoirs that surround the planets. Such a discovery is, of course, very threatening for us, and it may be asked whether our oceans and our atmosphere are rich enough to answer the needs of the rocks that will consolidate hereafter. It is easy to make a calculation on this point. The crust of the earth is at present so thin that a hen's egg has relatively thicker walls than our globe. If we suppose the consolidation pushed to its center, such a consolidation would require many times the amount of water which all our seas can furnish. Our satellite, the moon, which, by reason of its smaller volume, has reached the advanced degrees of refrigeration much more quickly than the earth, is now precisely at that phase in which all that was absorbable is engulfed in the voids of its crust. The day will come, then, when the earth, after having lost its atmosphere and its oceans after having had enormous rifts opened all over its surface, will be broken into meteoric fragments. Long before this time, all living beings, and especially human beings, deprived of the conditions necessary for existence, will have been extinguished. Let me note, moreover, that as the law of sidereal evolution is equally applicable to the sun, there will come a time when that radiant star will cease to vivify the planets. If they shall not already have been broken into pieces, they will become, by the extinction of the heat of the sun, unfit to be the dwelling place of living beings.

A distinguished professor whom science lost prematurely, M. Trouessart, whose mind had been much occupied with these questions, explained thus the future which awaits us, and at the same time made known his own preferences among the possible different destinies of the human race:

"Some day," he said, "that brilliant torch which is for us the source of light, of heat, of movement, and of life, will be extinguished, and we poor mortals (for how can we be indifferent to the destiny of our posterity?)—what will become of us? After dragging out the remnant of a dying life; after leading the sad existence of the Laps, the Esquimaux, the Samocides; after having retraced all the steps of our development, physical, intellectual, and moral, we shall end with exhaustion, misery, hunger and cold! A thousand times better for the earth to close its career with a mighty catastrophe, which would make an end of human beings while in full civilization, which would permit humanity to say to the universe which was crushing it, to use the fine expression of Pascal, that it is nobler than the universe; yes, anything rather than such a miserable end, in which thought itself will doubtless be extinguished before the wretched remains of the material life! Yet such a catastrophe science does not foresee, while it foresees the extinction of the sun."

The theory of sidereal evolution dissipates this sad perspective. Since we have the certainty that neither the reason nor the sense nor the heart which has been bestowed on us is an illusion, let us also have confidence that the reality which is before humanity is worth far more than all that we, in our profound ignorance, can conceive of as the best.—Stanislas Meunier.

Liquid Fuel.

It has so often been said that one ton of oil fuel will make as much steam as two tons of good coal, that the statement has met with tolerably general acceptance; and very imposing structures have been built upon it. It is, however, like many other assertions, one that will not bear the test of careful scrutiny. It originated, there is reason to believe, with more or less sanguine inventors; and it may be true when certain qualities of coal and of oil are compared; and, again, petroleum may be better adapted for burning to advantage under special circumstances than coal. But it is well known that the precise merits of petroleum have not been advocated on such a practical basis as this. It has been maintained that petroleum, when burned in a suitable furnace, will give out twice as many heat units as a pound of coal; and no doubt the announcement that "Russoline," as used in oil engines at the Cambridge Show, is little more than one-fourth better than coal, came as a startling surprise to many people. It is just as well, however, that the precise truth should be known, and its proper value assigned to oil fuel. There is little difficulty in doing this, as soon as the composition of the oil is known.

The so-called hydrocarbons are of multifarious and most complex composition. There are hundreds of them, between the highly volatile benzines and the dense tar-like stuff known as astaki, and all may be obtained by fractional distillation from almost every sample of crude mineral oil. With the details of the chemical construction of rock or mineral oil we need not now concern ourselves. There are only two "fuels" properly so called in petroleum. The one is hydrogen, the other carbon, and these exist in varied proportions in different samples. The complete combustion of one pound of hydrogen to water will develop 62,000 British thermal units, and one pound of carbon will develop in like manner 14,500 thermal units. The average specific gravity of crude petroleum is probably somewhere about 0·87, and its composition about 85 per cent carbon, 13 per cent hydrogen, and 2 per cent oxygen. The evaporative efficiency of one pound of this fuel is thus: $14,500 \times 0{\cdot}85 = 12,325$ units for the carbon; $62,000 \times 0{\cdot}13 = 8,600$ for the hydrogen; and $12,325 + 8,600 = 20,925$, say 21,000 units for the whole. It will be seen that this is a long way from the 29,000 units needed to be equal to double the value of good coal.

But this is not all. There are on the market petroleum oils which contain much less than 13 per cent of hydrogen. Thus there are samples which have 11 per cent hydrogen and 87 carbon; the value of these is only 19,400 units. D. K. Clark finds the average value of a number of samples to be 20,420 units. The number 20,000 is easily remembered, and if we assign that to petroleum as its calorific value in units, we shall do it no injustice. When we come to consider the petroleum oils obtained by distillation from the crude liquid the case is apparently very much better for the oil, for specimens may be had with as much as 28 per cent of hydrogen and an efficiency of about 27,000 units, or very close to twice that of coal. But oils of this character cannot be used for raising steam. In the first place, they are too dear; but even if this difficulty were got over, we should not be better off, because the specific gravity is little more than 0·7, and it ignites at about 86°. Such fuel would be much too dangerous for use, partaking, as it does, of the nature of a benzine. It may be quite possible, however, to use it in an oil engine, and attempts to do this have been attended with varying measures of success; but for boiler work its use is out of the question. The form of the oil best adapted for raising steam is no doubt astaki. This has not been made the subject of much chemical investigation; it is the residue left in the stills when the lighter benzines and paraffines have been driven off. It boils at high temperatures, as much as 490° indeed. What its chemical composition is we are unable to say with any certainty; probably no two samples are quite alike. There is reason to believe, however, that it is deficient in hydrogen, and that its value in units does not exceed, if it equals, 20,000 units. That is to say, it is, weight for weight, about one-half better than coal. If a given quantity of coal will evaporate 14,500 pounds of water, then an equal weight of astaki will evaporate 20,000 pounds of water. The drawback to its use is that, ton for ton, it costs about twice as much as coal; consequently it is a very expensive fuel.

We see then that the startling claims advanced by inventors of various systems of burning petroleum have no real foundation in fact, and they tend to retard the use of oil fuel rather than promote it. The right spirit in which to approach the subject is, while not expecting too much in the way of evaporative efficiency, to bear in mind that it is unfair to compare its price with that of coal in England only, and to remember that it is a superbly convenient fuel, involving the least possible trouble in burning it. As to cost, we compare petroleum here at say 25s. a ton with coal at 10s. or 12s.; but steamers trading through the Mediterranean and into the Black Sea will have to pay £2 10s. per ton for their coal, while petroleum may be put on board for less than the cost of coal in England, and astaki can be had almost for the cost of putting it into the tanks. To utilize oil fuel, then, properly, it appears that marine boilers should be so constructed that they will, like Mr. Holden's locomotives, burn either fuel indiscriminately, so that as the cargo steamer moves from port to port, she will always be able to provide herself with that form of fuel which can be had at the lowest price.

Hundreds of patents have been secured for different methods of spraying and burning liquid fuel. The great secret of success seems to lie in so arranging matters that the flame will not put itself out and prevent the oil from being properly consumed. If we put a bit of flaming paper over the chimney of a lighted lamp, the paper will be extinguished by the uprush of carbonic acid from the lamp flame. In the same way, when petroleum spray is directed into a furnace high up, it cannot burn, because the upper part of the fire box contains little or no free oxygen, the spray is driven unconsumed through the flame, strikes the bridge or fire stone, and runs down it to be burned—usually badly—below. The jet of oil should enter near the grate bars, but the precise height is a matter of adjustment, involving special knowledge not to be imparted by letterpress. As regards the spraying, that is usually effected by steam, but the practice is very objectionable, because the quantity used is very considerable, and represents great waste of fresh water, which must be made up again for the sake of the boilers, at least in the case of sea-going steamers. The use of compressed air appears to be better, but it is worth while to consider whether either air or steam is needed. It might be found practicable to get rid of both by driving the oil in through very fine nozzles—needled if desirable—under heavy pressure. This device has been employed in oil engines with much success, and we do not see why it should not be made to answer for furnaces. If it can be used, it disposes at a stroke of several serious objections to the use of liquid fuel at sea, and a very moderate sum would suffice to test the value of the idea. The principle involved cannot be made the subject of a patent, but the experimenter might secure himself an adequate reward by patenting the details of the apparatus by which it was carried into practice.—The Engineer.

Increasing and Varied Uses of Aluminum.

The Aluminum World gives the following table showing the quantity, price, and total value of manufactured aluminum for each year from 1884 till 1893:

Date.	Pounds.	Price per pound.	Value (total).
1884	150	$9.00	$1,350.00
1885	283	9.00	2.550.00
1886	3,000	9.00	27,000.00
1887	18 300	3.27	59,000.00
1888	19,000	3.42	65,000.00
1889	47,468	2.04	97,335.00
1890	61,281	1.55	61,281.00
1891	150,000	.66	100,000.00
1892	259,885	.66	172 334.00
1893	339,629	.75	266,903.00

The decrease in price in 1891 and 1892 was due to an infringement contest which produced competition among the manufacturers.

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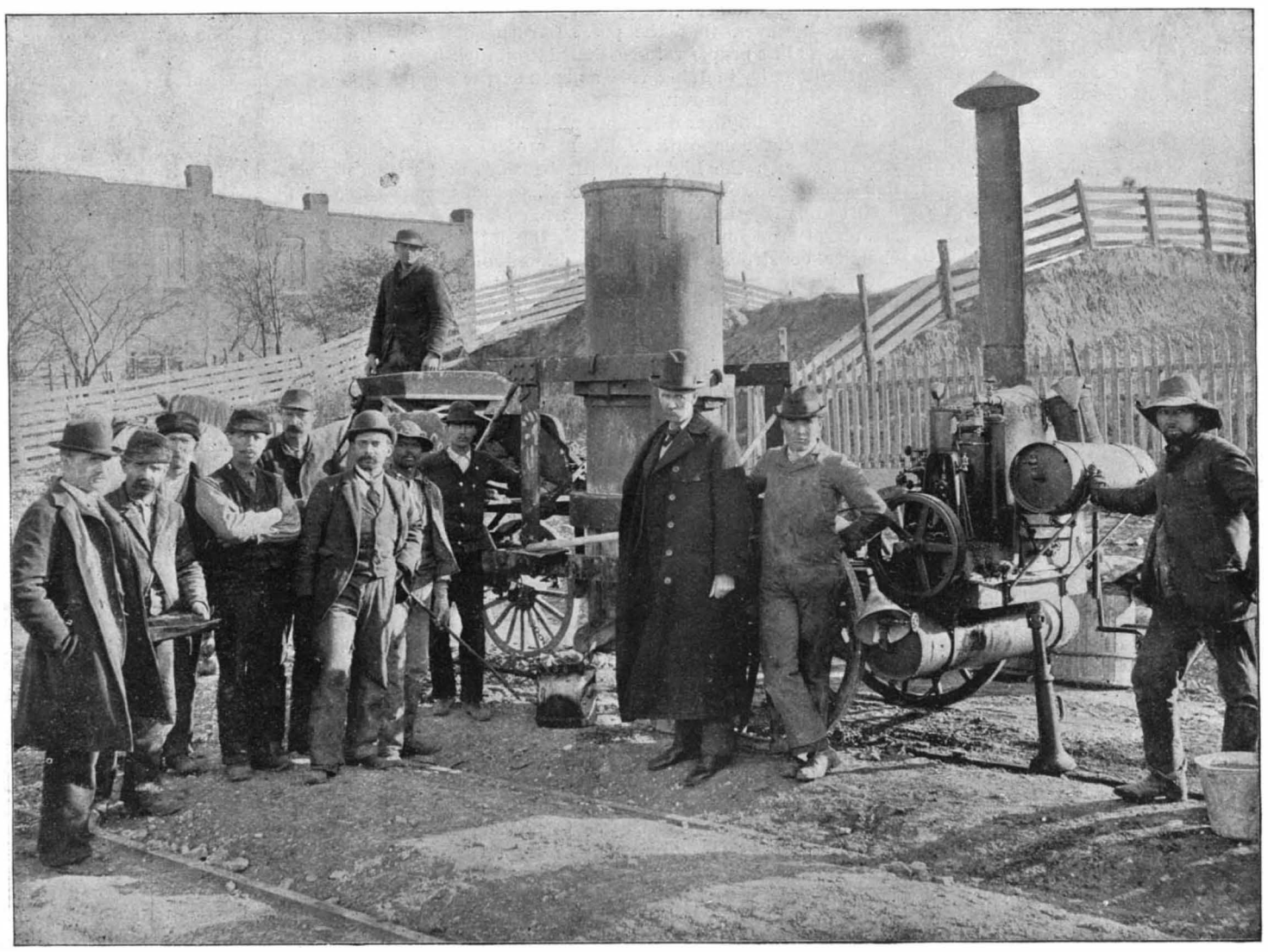
CAST WELDING RAIL JOINTS.

The electric welding of railway rail joints has, from its inception, attracted the especial attention of street railway managers, particularly those operating trolley lines. In the accompanying illustrations we present another method of welding rail joints, recently brought forward by the Falk Manufacturing Company, of Milwaukee. It consists in casting around the meeting ends of the rails, in heated metal moulds, a large body of melted iron, the principal portion of the metal being directed about the base and web of the rails, and thus effecting, it is claimed, a good weld between the iron and the steel of the rail. The iron is poured into the moulds from a ladle, as in an ordinary foundry, and it is stated that the union of the parts thus attained, as shown by broken sections through joints and pieces of casting, is equal to that commonly made by good welding.

This method of welding has recently been put upon practical trial on about three miles of railway in St. Louis, and has also been employed in the repair of thirty-seven joints in six miles of track which had been electrically welded. In operation the first thing, of course, is to dig up the paving and expose the joints. Meanwhile the moulds, which are of common cast iron, are thrown in a heap somewhere near by and a fire built around them, so that by the time they are to be put around the joints they are a dull red. The moulds are lined with a composition of graphite and another substance applied with an ordinary paint brush. The moulds are relined in this way for about every twenty joints cast in them. They can be lined while hot and it takes about half a minute to reline a pair. Before the moulds are applied the rails near the ends are cleaned, and if the ends do not butt together closely, a thin section of rail is driven in to fill the crack. The moulds are then put around the joints and the metal is poured. The outfit is practically a small foundry cupola on wheels, the one used in St.

RUNNING THE METAL.



CASTING OUTFIT READY FOR WORK.

CAST WELDING FOR RAILWAY RAIL JOINTS.

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Louis, and shown herewith, weighing 7,000 pounds. It made seventy joints a day, but outfits having a larger capacity are now being manufactured. The cupola is hung on gimbals, keeping it always level, and behind it is a small steam engine which drives a blower furnishing an air blast. The engine takes care of itself to a large extent, as the feed is automatic, being regulated by the height of water in the boiler, and the oil fuel flow is regulated by the pressure of the steam. The air pipe between the blower and cupola has a flexible joint, to allow for the movement of the cupola on its pivots, and under the engine can be seen the tank for water supply.

The moulds have eyebolts, so that they can be handled with iron hooks. They are held in place with ordinary clamps and are of such shape as to fit up snugly against the rails and hold them firmly in line until the joint has cooled. As shown in the engravings the cracks on top between moulds and rails are filled with clay and sand. A plate of iron is laid over the crack between the ends of the rails, so that when the iron attempts to rise there it is suddenly chilled and prevented from flowing out on top of the rail. Underneath the moulds the crack between the halves is closed by holding a pan of sand up against it. The moulds can be put on a joint in about two minutes. The moulds are hot when put on, and they are allowed to stay on long enough to heat the rail ends. After the iron has been poured in, about ten minutes is allowed to elapse before the moulds are taken off and put on another joint. About a dozen sets of moulds are kept in use at once. Every other joint of a section of track is cast in the morning and in the afternoon the remaining joints are cast, to prevent, as far as possible, the severe strain of contraction and expansion, as the operation heats the rail for some distance on each side.

The joints made at St. Louis weighed 120 pounds each. They may, of course, be made of any desired weight, and this would seem to be a very large mass of metal to deposit at each rail joint. The joints first made by the company weighed only 54 pounds each, and it is claimed that such a joint, when placed on blocks two feet apart, withstood a downward test pressure of 100,000 pounds. The 120 pound joint covers four bolt holes, and the cost of each joint is stated to be about $3.

It is said that the welding action between the rail and casting takes place around the base and about two-thirds of the way up the web of the rail only, so that if the joint is defective and breaks, the head of the rail remains intact. Another advantage claimed for this improvement is that a solid mechanical joint may be made thereby by slightly varying the method and preventing the welding action, such a joint allowing for the contraction and expansion of the rails.

Although this process has not yet been sufficiently employed to determine its ultimate value, it is being looked upon with considerable interest, especially by the managers of small street railway systems, as the initial cost of apparatus for electric welding is very much higher than that of this system, and the electric apparatus is more expensive to maintain. One of the views represents one of the lugs knocked off a broken electrically welded joint, showing that welding took place on but a comparatively small portion of the area. It is said that a cupola plant for making and mending joints on a small system can be furnished at a cost of less than $1,000, so that, with its use, there need be no angle bar joints on the entire road. For illustrations and details we are indebted to the Street Railway Review.

CUPOLA AND CREW.

FILLING MOULDS.

LUG FROM DEFECTIVE ELECTRIC WELD.

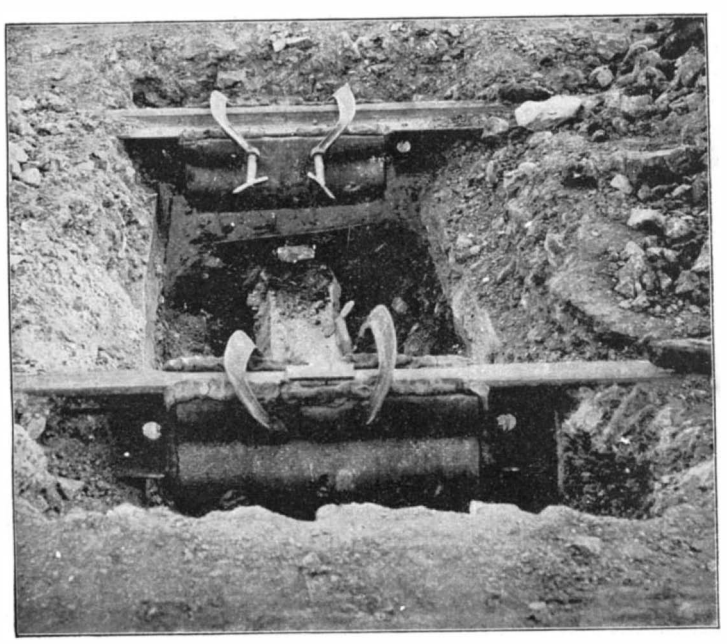
Parcel Service on Street Railway Cars.

It is not generally known that a number of the street railways are being brought into general use for carrying various forms of light merchandise. Statistics recently gathered on the subject show that one hundred and twenty-five street railway companies of the country are regularly employed to carry the mails, sixty-nine roads are used to carry parcels under regular contracts, and some ninety-two roads have made provision for carrying other light forms of merchandise. It is probable that the practice will be greatly extended in the next few years, for the advantages of such a system are much too important to be neglected. The street cars reach a great many important points and they run with almost absolute regularity, since every precaution is taken to guard against their stoppage or delay.

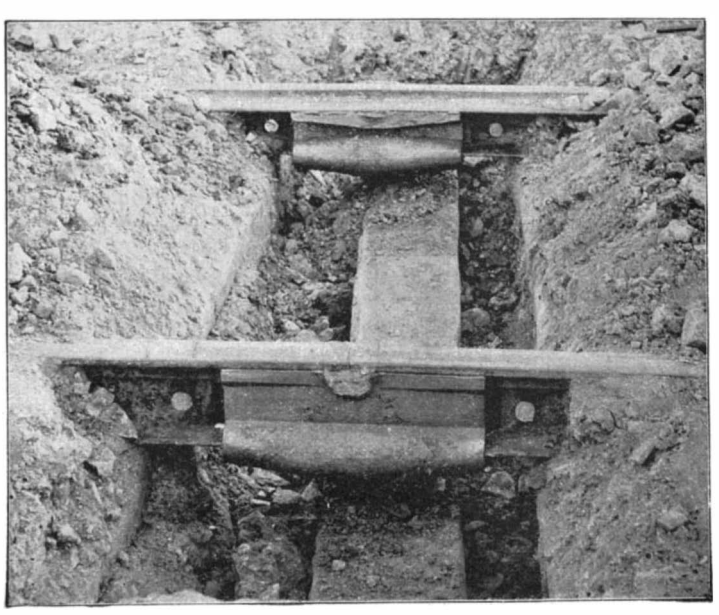
Some of the plans in operation in different parts of the country for utilizing the street cars are interesting. On one of the trolley lines of St. Louis, for instance, a regular delivery service is in operation, involving the collection and house to house delivery of ordinary express packages. This particular line starts in the heart of the city and runs for seven miles through a thickly settled district. A delivery car used for the work makes three trips per day, running on schedule time. The car is especially equipped for the purpose and is mounted on motors of its own, since the ordinary form of motor would not be sufficiently powerful. The car starts from a down town receiving station, where a clerk receives all parcels and keeps the books pertaining to the service. The important feature of the system is the work of collection and delivery along the route. The company use five wagons in the work, two of which are kept at the down town end of the road and the others meet the cars at fixed points along the road. These wagons call for packages in the usual manner, and deliver them to the express car, and the car carries it to the proper wagon for its delivery. The plan has proved so efficient that many of the large retail stores along the route which make a practice of delivering packages have ceased to run their delivery wagons to the part of the city along the trolley line, and now consign all their bundles to this express company. Formerly the express wagons made but one delivery per day, and at present the street railway makes three regular deliveries. Several large factories along this route consign all their goods to the "Electric Express." The company assumes all the responsibilities of a common carrier and is held responsible for all loss or damage. The service is not found to interfere with the regular running of the cars, and in the two years it has been in operation has never failed to pay.

Street Car Transfers in Baltimore.

The transfer system among the street railroads of Baltimore has grown since its introduction in 1882, and free transfers are now issued at some 40 different points; in some cases it is possible to ride 20 miles for a single fare. As a rule, in any city transfers are confined to different lines of one company; but at a crossing of the Lake Roland Elevated and Central roads free transfers are given from one to the other. A station is located at the junction and an agent provides the transferring passengers with a ticket. At the end of each quarter officials of the two companies meet, exchange coupons and divide equally the residue of fares collected by one company over the other. It is a very simple arrangement, and has resulted in greatly increasing the traffic of both roads.



MOULDS ON JOINTS.



JOINTS FINISHED.

CAST WELDING FOR RAILWAY RAIL JOINTS.

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Physical Decay.

"If the repair were always identical with the waste, life would then only be terminated by accident, never by old age." This is a fact well known to all who have investigated the subject, though Mr. G. H. Lewes, in his "Physiology of Common Life," makes the statement quoted. In early years this balance of the human system is admirably preserved. As man advances in life, however, and gets up to 50 or 60, he begins to get stiff in the joints, and experiences what he calls "feeling his age." Renovation of various organs of the body depends on the blood, and if this supply is not at all times furnished in sufficient quantity and quality, a gradual deterioration takes place. Heart and arteries become clogged, and the whole delicate machinery suffers from the lack of nourishment. Deposits of phosphate and carbonate of lime accumulate, and the change is really a chemical one, by which the blood is hindered from going to the extremities of the system and fulfilling its work of repair and renovation. Old age, then, is the result of a change in the blood, which becomes overloaded with earthy salts, leaves its refuse matter in the system, and the valves of the heart become cartilaginous. Becoming thus, the heart is not able to propel the blood to its destination. Arteries also having become ossified, a still further obstruction takes place, and the whole body languishes. Blood is life. If it is kept continually in good order, our years are prolonged. New bodies, as in youth and early manhood, do not accumulate these fibrinous and gelatinous deposits, which, as the years go by, help the gradual process of ossification and cause the decrepitude of age. Now if some means were discovered by which the blood could be kept in a condition like that of youth, it would throw off these earthy salts which obstruct the action of the heart and arteries. Our food and drink make our blood. It seems, then, that it is to them we should look primarily for the quality of it.

Without eating and drinking there is no life, but we may select certain kinds of foods containing a minimum amount of the elements which cause the ossific blockages in the system. An English physician, Dr. C. F. De Lacy Evans, who made many researches in regard to our food, comes to the conclusion that more fruit should be eaten, especially apples, grapes, and bananas, they being rich in nutritious elements. Being deficient in nitrogen, they are best for elderly people, as they keep the blood in a better condition than flesh. After the age of 60 people should eat less beef and mutton, and use more apples and nuts of all kinds, the latter being rich in many of the nutritious elements of meat. Fish and poultry have not the objectionable earth salts of beef. In order to retard physical decay and to keep the blood in a wholesome condition distilled water is recommended. It has solvent qualities which act upon the earth salts in the blood and expel them from the body. A goblet of this water taken three times a day, with ten or fifteen drops of diluted phosphoric acid in each glass, has a tendency to assist the blood in eliminating the obstructing salts. A man is as old as his arteries. If they are soft and compressible, the deteriorating effects of old age have not appeared.

Flourens, in his well known work on "Human Longevity," cites the case of the Italian centenarian Cornaro, whose recipe for health and long life was extreme moderation in all things. Flourens himself insists that a century is the normal life, but that 50 years beyond, and even 200 years, are human possibilities under advantageous conditions. Hufeland also believed in 200 years as an extreme limit. Sir James Crichton Browne, M.D., concedes, in a late address, that Flourens was right. Duration of growth gives the length of life. Hufeland held that the human body grows till the age of 25, and that eight times the growth period was the utmost limit of man. But if 20 years be taken as the time of growth, even five times that will give us a century. According to Flourens and Cuvier, man is of the frugivorous or fruit and nut eating class of animals, like the gorillas and other apes and monkeys. Man has not teeth like the lions and carnivorous beasts, neither has he teeth like the cows and herbivorous oncs. Intestines in the man are seven or eight times the length of the body; the lion's are but three times the length of his body. Herbivorous animals, like the cow, have intestines forty-eight times the length of the body.

So judging man by his teeth, his stomach, and his intestines, he is naturally and primitively frugivorous, and was not intended to eat flesh. Fruit is aperient, and apples act on the liver, and are good brain food also, as they contain much phosphoric acid. As to the effect of certain climates, perhaps too much stress has been laid upon that. We find that Thomas Parr, who lived in England, died in his 153d year, and was dissected by the celebrated discoverer of the circulation of the blood, Dr. William Harvey (who expressed no doubt of his age), was never out of his native country. Accounts of men who have lived to extreme age in Ecuador and Mexico indicate possibilities. A climate that allows much outdoor living is the best for health. More depends on food than on any climate. Exercise, fresh air to live in and to sleep in, daily bathing, and freedom from medicine are the important things. In July, 1893, the Courier Journal, of Louisville, published a long account of James McMullin, who died in Carlisle County, Ky., at 117 years of age. When Buffon, Hufeland, Flourens, and men of that class, who had studied the subject, believed in the possibility of 150 or 200 years of life, the subject is not to be laughed at.—William Kinnear, in Harper's Weekly.

FOSSSL FROST CRACKS.

BY J. A. UDDEN, ROCK ISLAND, ILL.

Sun cracks have long been known to geologists as characteristic of littoral deposits. During the summer season they are quite often to be seen on the muddy shores of larger waters and still oftener, perhaps, on the bottom of desiccated inland ponds. Their recognition in the fossil state was easy. But there is another kind of mud cracks which are produced under quite different conditions of less common occurrence, and these have, perhaps, but seldom been preserved during past ages.

Their making may be described as follows: When mud freezes, the water which it contains has a tendency to crystallize. The crystals begin to grow on the surface, and a continuous coating of ice is apt to form, if water is present in sufficient quantity. Such a coating will be much thicker along certain lines where the freezing commenced, and the ice will often extend as a thin plate some distance down in the mass, which is thus fissured by clefts filled with ice crystals. These clefts are mostly straight, and they branch and cluster after the crystalline properties of water, uniting preferably at angles of 60 and 120 degrees. When dry winds cause the crystals to disappear, as sometimes will happen, the empty cracks remain open and exhibit perfectly the forms of the branching plates which made them.

As a result of the special conditions attending their

FROST CRACKS ON A BLOCK OF SANDSTONE IN THE BLACK HILLS, S. D.

formation, frost cracks are quite unlike sun cracks in their appearance. The most important points of difference may be tabulated thus:

SUN CRACKS	FROST CRACKS
are jagged and curved irregularly,	are straight,
are of somewhat uniform and rather large width,	are apt to taper to a point at one end and are narrow, and
tend to form a network with six-sided meshes and, as a consequence, often meet in tri-radiate clusters	form branching tree-like patterns, in which shorter members run out from one side of a longer main stem
at various angles approximating 120 degrees.	usually at angles of 60 and exceptionally at 120 degrees.

While out on a tramp in the Black Hills last summer, the writer found some fossil marks that appeared to be frost cracks produced in this way. They were seen on some blocks of sandstone resting on a talus about three miles south-southwest of Minnekahta station in the southern foothills. The blocks were evidently detached from a ledge which comes in a little below some strata that have lately yielded a number of petrified stems of cycad trees. On one side these blocks presented an unusually smooth and plane surface, which was almost glossy and covered with a coating of fine red material about $\frac{1}{50}$ of an inch in thickness. There was something of a resemblance to an ice surface. It bore impressions which corresponded to the description of frost cracks as given above. The lines were but slightly sunk below the plane of the surface and measured from one-half to four inches in length and from one-sixteenth to one-eighth of an inch in width. Some of the branched patterns they formed were over eight inches in length, and most of the angles observed measured just sixty degrees, while a few of them exceeded seventy and even eighty degrees. Quite a few lines also met at angles of one hundred and twenty degrees.

The series of sandstones and shales to which the rocks of this locality belong furnishes sufficient evidence of shallow water conditions attending its making. This consists in ripple marks, cross bedding and the remains of ancient land plants. Sun cracks are also known to occur. The rocks were made during a period of transition between the Jurassic and the Cretaceous ages. This is known to have been a time of increasing cold, when the tropical plants of the earlier age were giving place to the temperate vegetation of the later. During an age of such changes it would, indeed, be quite probable that a frozen mud flat should occasionally become buried under the sediments of an advancing tide, and to such a contingency the singular markings on these sandstone blocks are probably to be ascribed.

Muzzle Velocity of Shot.

In the course of his first Cantor lecture, delivered before the Society of Arts on "Explosives and their Modern Development," Prof. Vivian B. Lewes referred to the method of determining the muzzle velocity of shot which is effected by means of the chronograph. He said:

"Two screens are arranged, one about 120 feet from the muzzle of the gun, and the second 120 feet beyond the first. These screens consist of wooden frames strung with fine copper wire, the disruption of a single strand of which is sufficient to break the flow of the galvanic current. In the Boulenge chronograph, a current from a battery of eight Bunsen cells flows through these wires and back to the instrument house, where the wire from each frame is coiled round a separate soft iron core and converts it into an electro-magnet, each of which attracts and holds a rod of steel. The electro-magnet in connection with the second frame is fixed at a lower level than the electro-magnet connected with the first, and carries a short rod with a weight at the bottom, while the first magnet is at a much higher level, and carries a longer rod. The current being allowed to pass through both electro-magnets, the rods are suspended in position. By pressing a key both circuits can be simultaneously broken, with the result that both the rods are liberated and drop down guide tubes; the short rod strikes a catch and causes a knife edge to be brought against the longer falling iron, and to make a nick in it. When both rods are liberated simultaneously, this nick occurs at a definite place. The current is then allowed to pass, the rods hung on the electro-magnets, and the gun containing the charge, the power of which is to be tested, is fired, the projectile passing through the screens and breaking the current by cutting the wires. Under these conditions the long rod is liberated a fraction of a second sooner than the shorter rod, the result being that the nick of the knife blade is no longer in the original place. By measuring the distance between the two nicks, and knowing the length of time to which this is equivalent, allowance being made for the time taken in liberating the knife blade, etc., the interval of time which elapses while the projectile is passing between the screens can be calculated, and, being corrected for the distance of the first screen from the muzzle, gives the muzzle velocity of the projectile."

Cooling Devices for Dwellings.

It must be something like fifteen years since the air of the Madison Square Theater was artificially cooled in summer by passing it over ice; and refrigerating apparatus is in use in every large city in the civilized world, for cooling rooms for the storage of provisions. Many attempts have been made to introduce refrigerating apparatus of the same sort as that used in the cold storage buildings into dwelling houses, but they have failed, and with reason, to please the public. The apparatus now attracting the attention of the newspaper reporters is simply an ammonia machine, depending for it frigorific properties on the alternate condensation and expansion of ammonia gas. To judge from the accounts, the apparatus is, as a piece of machinery, well designed, but the descriptions of the methods by which it is intended to convey the chilling influence to the rooms of a dwelling are rather amusing. We are told, by way of introduction, that the use of ice for cooling rooms causes "dampness," while the ammonia apparatus produces "a pure, dry cold." It is hardly necessary to say that the facts are just the other way. When warm air, which, in inhabited buildings, is always moist air, is passed over ice, after the Madison Square plan, the moisture of the air is condensed by the reduction of temperature, and deposited on the ice, to be carried away with the drainage water from the ice; and the air which passes beyond the ice is not only cool, but comparatively dry, as its moisture has been, so to speak, wrung out of it by the ice.

With pipes filled with ammonia-chilled liquid running through the room to be cooled, the case is reversed. All the moisture originally contained in the air remains in the room. Such air as comes in contact with the cold pipes will deposit its moisture in the form of drops of water, which will either fall on the floor or must be collected in some way and drained off; while the remaining air will be held at the point of saturation. A more unwholesome atmospheric condition it would be difficult to conceive than the reeking, dripping, chilly dampness of a room to which such a cooling system had been applied.—American Architect.

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The Effects of Intense Cold upon the Mind.

Extreme cold, as is well known, exerts a benumbing influence upon the mental faculties. Almost every one who has been exposed, for a longer or shorter period, to a very low temperature has noted a diminution in will power, and often a temporary weakening of the memory. Perhaps the largest scale upon which this action has ever been studied was during the retreat of the French from Moscow. The troops suffered extremely from hunger, fatigue, and cold—from the latter perhaps most of all. A German physician who accompanied a detachment of his countrymen has left an interesting account of their trials during this retreat. From an abstract of this paper by Dr. Rose, in the New Yorker Medicinische Monatschrift, we find that of the earliest symptoms referable to the cold was a loss of memory. This was noted in the strong as well as those who were already suffering from the effects of the hardships to which they had been exposed. With the first appearance of a moderately low temperature (about five degrees above zero Fahrenheit), many of the soldiers were found to have forgotten the names of the most ordinary things about them, as well as those of the articles of food, for the want of which they were perishing. Many forgot their own names and those of their comrades. Others showed more pronounced symptoms of mental disturbance, and not a few became incurably insane, the type of their insanity resembling very closely senile dementia. The cold was probably not alone responsible for these effects, for a zero temperature is rather stimulating than paralyzing in its action upon the well-fed and the healthy. These men were half starved, poorly clad, worn out with long marching, many already weakened by dysentery and other diseases, and all mentally depressed, as an army in defeat always is. It needed, therefore, no very unusual degree of cold to produce the psychic effects observed under other circumstances only as a consequence of exposure to an extreme low temperature.—Medical Record.

Will Coal Dust Explode?

That the dust of certain coals is explosive has been asserted time and time again in these columns, and evidence in support of the assertion has been abundant. We now have fresh evidence in a series of experiments conducted by Mr. W. Galloway, formerly one of the British mine inspectors, at Merthyr, on December 1. Mr. Galloway fitted up special apparatus with internal fans for the purpose of mixing the dust with the air. No gas was used, as the object of the experiments was to determine whether coal dust alone was explosive.

Before commencing his experiments, Mr. Galloway delivered an address to a number of gentlemen interested in the matter. In the course of his address he said that the reason the coal dust theory had not been more generally accepted as the cause of great explosions in deep, dry mines was because the public had not had opportunities of seeing dust in actual explosion. He had therefore determined to make these public experiments so as to convince skeptics that the theory was correct. He explained that when explosions occurred in dry mines the flame traveled through the intake airways and not through the returns or the faces, the reason being that the intakes, being the main haulage roads, were naturally very dusty, and this dust was deposited on the ledges and timbers, ready, when a disturbance occurred, to be mixed with air and become explosive. He further stated that whenever, after an explosion, smoke or dust issued from a mine, and wherever charred coke was visible on the timbers, it was safe to say that a coal dust explosion had occurred, or that coal dust had been the principal cause of the explosion, for a fire damp explosion produced no smoke and left no charred coke on the timbers.

The reason why, after some explosions, charred coke was found in some parts of the mine and not in others was explained by the fact that in these parts where coke was discernible the dust had been pure coal dust, whereas in other parts of the mine the coal dust on the roadways was largely mixed with stone dust, and although there was sufficient coal dust to be inflammable and to carry on the explosion, the admixture of stone dust prevented the formation of coke. In order that coal dust might combine rapidly with air and form an explosive mixture it had necessarily to be very fine. It would not ignite immediately if taken from the roads, there were too many coarse particles in it, but the coarse particles would rapidly fall to the ground and the mixture in the air become explosive.

The following is a list of Mr. Galloway's experiments, with the reported results:

1. A cannon shot, with 1 oz. of gunpowder, stemmed with great care, but not too tightly, placed on a ledge 9 in. from the ground, fired into vacancy, produced a flame 3 ft. long.

2. A cannon shot, with 1 oz. of gunpowder, stemmed as before with 1 oz. of coarse coal dust, made a flame 7 ft. long, fired from the same place and position.

3. A cannon shot, 1 oz. of gunpowder, stemmed with 1 oz. of coal dust, mixed with ⅛ oz. of heather dust, made a flame 8 ft. long, but of greater volume.

4. A cannon shot fired into the tube, where 1 lb. of coal dust had been placed and stirred, caused a flame 12 ft. long.

5. A shot with 1 oz. of gunpowder, stemmed with 1 oz. of coal dust, fired into the tube, which contained 1 lb. of coarse coal dust, produced a flame 15 ft. long with a greater volume.

6. Shot, stemmed as before with powderand coal dust mixed with ⅛ oz. of heather dust, produced a flame 14 ft. long.

7. Similar shot fired into tube containing ½ lb. of finest coal dust produced a flame 14 ft. long.

8. Similar shot, 12 oz. finest coal dust, flame 14 ft., greater volume.

9. In this case no additional dust was placed in the apparatus, but some remained since last shot; 1½ oz. gunpowder used, flame 9 ft. long.

10. No additional dust, similar shot, 10 ft. flame.

11. Similar shot, tube entirely free of dust, 1 oz. of gunpowder, flame 5 ft. long.

12. Similar shot, no dust, tighter stemming, flame 5 ft., report considerably louder.

13. Shot with 1 oz. gunpowder, fired into a mixture of stirred-up coal dust, produced flame 14 ft. in length.

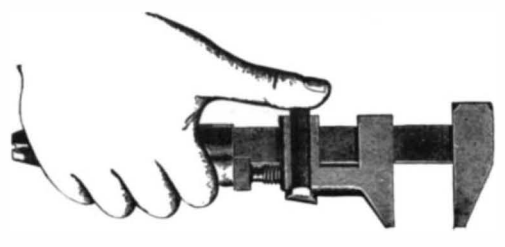
14. Similar shot, 12 oz. coal dust, flame 12½ ft. long.

15. Similar shot, 1½ lb. of coal dust, flame 16 ft. long.

16. Similar shot fired into tube extended to 18 ft. long, containing 2 lb. of coarse stirred-up coal dust, made a flame 23½ ft. in length.—Colliery Engineer.

A CONVENIENT WRENCH.

The bar of this wrench is of open hearth steel, drop forged and case hardened, and it is designed to be an especially well made and durable tool. It is manufactured by the Standard Tool Company, Athol, Mass. The sliding jaw and the working parts are of hardened steel, and it is styled the "rapid transit wrench" from the fact that, by a slight thumb pressure at the point indicated in the illustration, the screw is released from engagement with a nut, and the sliding jaw may be moved in either direction without turning the



screw. The screw lies flat on the bar, preventing its being accidentally bent or sprung, and a spring under the point on which the thumb is represented normally draws the nut to a true bearing on the screw and takes up all wear.

The Electro Nickeling of Metallic Surfaces.

The following baths (most of them well known) have all given good results, but require careful handling:

1. 8 kilos. nickel ammonium sulphate in 100 liters of water, made slightly alkaline with ammonia, and then weakly acidified with citric acid.

2. 5 parts nickel sulphate neutralized with ammonia, 3·75 ammonium tartrate, and 0·025 gallotannic acid per 100 of water. This gives a homogeneous white and smooth reguline deposit, even when of great thickness.

3. 2·75 nickel acetate, 2·5 calcium acetate, and 100 of water, afterward mixed with 0·7 part of acetic acid (sp. gr. = 1·047) and filtered. (Potts' formula.)

4. 5 nickel ammonium sulphate, 2 ammonium sulphate, 0·5 citric acid, and 100 of water. Boil and filter.

5. 8 nickel ammonium sulphate, 1 ammonium chloride in 100 of water, with or without the addition of 0·5 part barium oxalate.

6. 6 nickel ammonium sulphate, 3·5 ammonium chloride, and 2·5 ammonium sulphate per 100 of water.

7. 5 nickel ammonium sulphate, 1 ammonium sulphate, and 100 of water. Specially suitable for cast iron.

8. 5 nickel ammonium sulphate, 2·5 boric acid, 100 water.

Powell has found that the addition of not more than 1 to 8 grms. per liter of benzoic acid or of a benzoate to a suitable nickel bath produces a good and pure deposit. Baths containing boric acid, such as are commonly employed, give a good deposit upon smooth surfaces, but refuse to cover cavities or hollows; this difficulty may be removed by the addition of sodium chloride to the bath. Such a bath may be made by dissolving 5 kilos. nickel ammonium sulphate in 100 liters of water, adding 2·5 (or 1·25) kilos. of boric acid and 1·25 kilos. of sodium chloride, boiling, acidifying with citric acid, neutralizing with ammonia, and filtering.

So also nickel chloride with boric acid in the proportion of 5:2 or 2:1 gives a good bath, but it is not suitable for depositing upon iron or steel, as all baths containing chlorine are apt to cause rusting of these metals. The use of citric, benzoic, tartaric, or other weak acids is to be recommended for them, except upon the score of expense.—Ding. Poly. J.

The Oil Fields in Ohio.

A number of very valuable oil fields have been discovered in Ohio the past year. The income from these wells, based upon their present output, promises to make an appreciable addition to the oil interest of the country. One of the new wells, known as the Kirkbridge, produces 310 barrels of crude oil per hour, or 7,440 barrels per day of 24 hours. Another single well averages over 1 200 barrels per day. To do the work of collecting, refining and shipping this immense product, an elaborate system of pumping stations, tanks, piping and other forms of machinery have been provided.

It is not generally known that the oil interests of Ohio have developed very rapidly of late, and that Ohio, as an oil producing State, promises to rival Pennsylvania. In a single county, Wood, the pipes for carrying the oil consist of 340 miles of 2 inch pipes, 70 miles of 3 inch pipes, 125 miles of 4 inch pipes, together with other sizes, making a total of some 800 miles of pipe, and representing an outlay of $15,773,000. In addition to this the oil territory contains 260 storage tanks, which have cost $6,000 each, and there are besides immense outlays necessary for bonuses, rentals, labor and building. At present the storage tanks of Wood County contain about 8,000,000 barrels of crude oil, valued at $4,400,000. During the past year the output of oil from Wood County alone has been 20,000,000 barrels of oil. In other counties of Ohio the interests are also very large. There are at present some 17,500 oil wells in Ohio. Of this number over 3,000 have been drilled during the past year.

The Registration of Trade Marks in Germany.

Under the act which came into force in Germany on October 1 of 1894, the local registrations of trade marks are completely abolished, and they must, in future, be registered at the Patent Office in Berlin. There the authorities take every precaution against innocent or other duplications of trade marks, or infringements of the rights of those who already own such things. When an application is made, the officials search the register, and if a trade mark in any way approaches that which is proposed to be registered, the owner of the old trade mark is communicated with. He can then take steps to prevent the new trade mark being registered, or, if it be a flagrant infringement, the government may perform this office on their own account. Also, the old plea of "ignorance of registration" is now abolished, and, by the new act, the infringer of a trade mark is liable to penalties and damages for "carelessness." The carelessness in question may simply consist in the fact that he did not properly search the register and find that he was doing wrong in using a trade mark which either did not belong to him or was a colorable imitation of an older mark. Under the old law, an English or foreign owner of a trade mark had to warn a German pirate before he could take action, but now this is abolished, and, if only the original trade mark be registered in Berlin, the owner can claim damages for infringement without giving warning to anybody. At present, the marks in the register under the old act can be registered under the new, and old foreign trade marks can likewise be protected.

Powder Engines.

In the course of an interesting lecture on "Modern Explosives," recently delivered by Colonel Barker, Superintendent of the Royal Small Arms Factory, Sparkbrook, reference was made to the possibilities of the industrial use of high explosives for generating motive power. The construction of a gunpowder engine has often been attempted. But this explosive is ill adapted for such a purpose—in the first place, because it only develops in combustion about 280 volumes of permanent gases, while the solid residues are very considerable, and would soon clog any machine. At the same time, it should be remembered that one pound of gunpowder is capable of developing 170,280 foot pounds of energy. The new smokeless powders are capable of developing still higher energy, and are also more under control, while giving off nearly 1,000 volumes of permanet gases, and leaving no solid residue. The temperatures developed by all these propellants are high; but it is very possible to overcome this difficulty, in the same way as it is done in the case of gas engines, or even by making use of the energy of the water so employed when converted into steam. As English cordite develops 1,250 calories per gramme, the possibility of its employment in some form of "powder gas" engine is not without attractiveness to engineers of a speculative turn. The temperature of gunpowder on explosion is about 4,000° Fah., and that of the smokeless powders is believed to be considerably higher, though this has not yet been fully determined.

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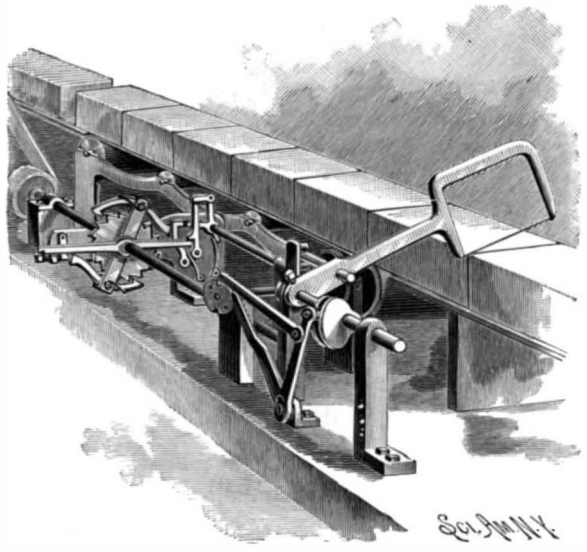
AN IMPROVED BRICK CUTTING MACHINE.

This brick cutter, recently patented by Messrs. Henry R. and Jacob Van Eyck, of Zeeland, Mich., is only three feet long and not two feet wide, and is said to be the smallest cutter on the market. It does not upset the stream of clay nor does it mar the faces of the brick as they are cut off at the die or nozzle of the brick machine, the parts being arranged to move the cutting lever as fast as the stream of clay travels, and thus cut a perfectly square brick. The traveling belt upon which the plastic clay issues moves over rollers



VAN EYCKS' BRICK CUTTING MACHINE.

journaled in a suitable supporting frame, as in other machines, and the cutting apparatus is operated from a driving pulley on a shaft at one side, to which is secured a ratchet wheel. This wheel is adapted to be engaged by dogs pivoted to opposite ends of an arm carried by an aligning shaft which operates the cutter, but the shaft has an intermittent motion, from the dogs being thrown into and out of engagement with the ratchet wheel through the operation of a bell crank lever and connections, whereby also the forward and backward movement of the knife carrier is effected. The dogs are tripped at every half revolution of the end rollers carrying the traveling belt, the driving shaft being actuated at such times to move the cutter up or down, and the movement of the roller effected by the travel of the clay sets into motion the devices which give the knife the cutting stroke as well as those that feed the knife along with the clay, although the mechanism itself is driven by independent power, so that the stream of material is not retarded and a nice clean cut is effected at every movement of the cutter. These machines are made by the Zeeland Machine Company, at Zeeland, Mich.

Influence of Different Rays of Light on Plants.

Herr E. Wollny finds that yellow light has the greatest power of producing organic substances in plants; next the red; while blue light has a remarkably prejudicial effect on the development of the reproductive organs. It is, therefore, the most refrangible (chemical) rays which take the least part in metabolism, the assimilation of carbon being carried on mainly by the less refrangible (illuminating) rays (Wollny's "Forschungen," 1894, p. 217). As the result of another series of experiments, M. Villon states that the vine produces a greater weight of grapes. which also contain a larger quantity of alcohol and of acid, when grown behind glass colored red violet by manganese, which absorbs the yellow and brown rays. Flowers are also favorably influenced by the same color, which is, moreover, advantageous to the growth of bacteria, yeast and silkworms.—Revue Scientifique.

THE work of excavating a channel of 20 feet depth through the waters of the Great Lakes between Chicago, Duluth and Buffalo, which was commenced in 1893, is now more than two-thirds completed. The work is divided into eight sections. The first four sections include the excavation needed in the Sault Ste. Marie River, through which there will be a channel 21 feet deep and 300 feet wide.

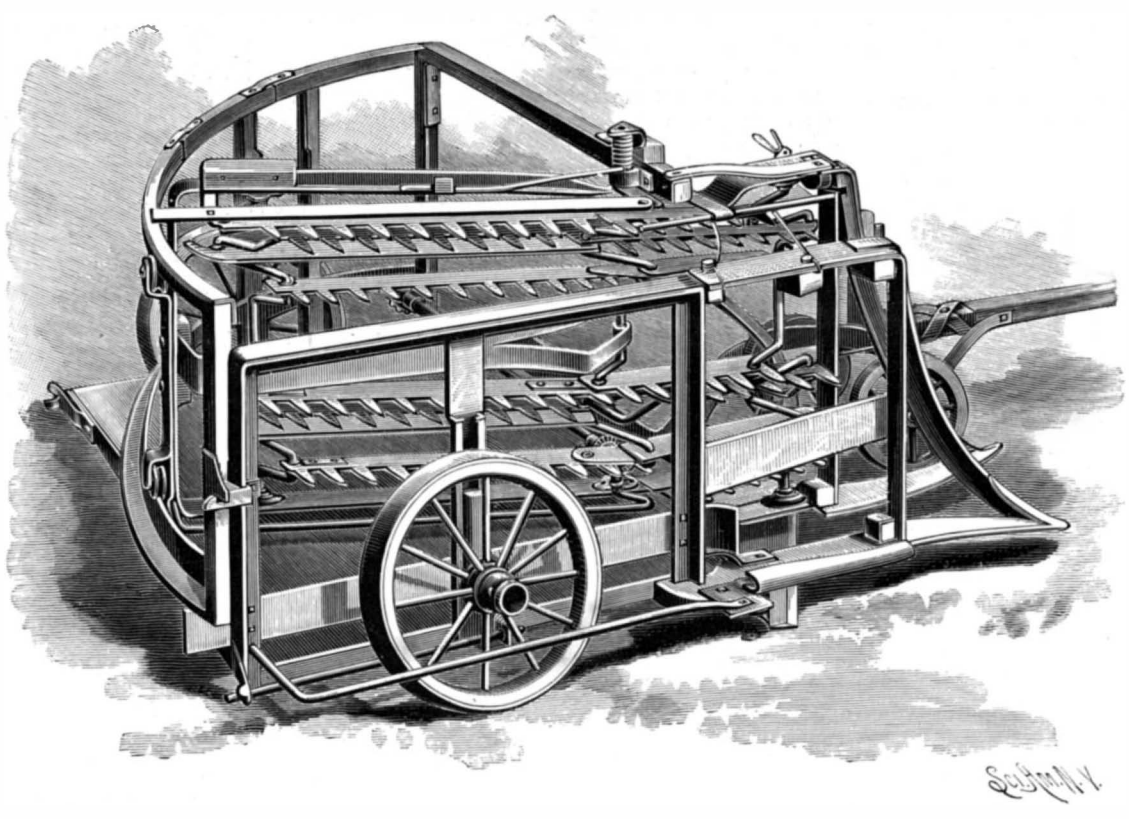
How to Clean Clothes.

The American Analyst tells how to do it, as follows: Take, for instance, a shiny old coat, vest or pair of trousers of broadcloth, cassimere or diagonal. The scourer makes a strong, warm soapsuds, and plunges the garment into it, souses it up and down, rubs the dirty places and, if necessary, puts it through a second time; then rinses it through several waters and hangs it up to dry on the line. When nearly dry he takes it in, rolls it up for an hour or two and then presses it. An old cotton cloth is laid on the outside of the coat and the iron passed over that until the wrinkles are out; but the iron is removed before the steam ceases to rise from the goods, else they would be shiny. Wrinkles that are obstinate are removed by laying a wet cloth over them and passing the iron over that. If any shiny places are seen, they are treated as the wrinkles are—the iron is lifted while the full cloud of steam rises and brings the nap with it. Cloths should always have a suds made specially for them, as in that which has been used for white cotton or woolen cloths lint will be left in the water and will cling to the cloth.

In this manner we have known the same coat and trousers to be renewed time and time again, and have all the look and feel of new garments. Good broadcloth and its fellow cloths will bear many washings, and look better every time because of them.

AN IMPROVED CORN HARVESTER.

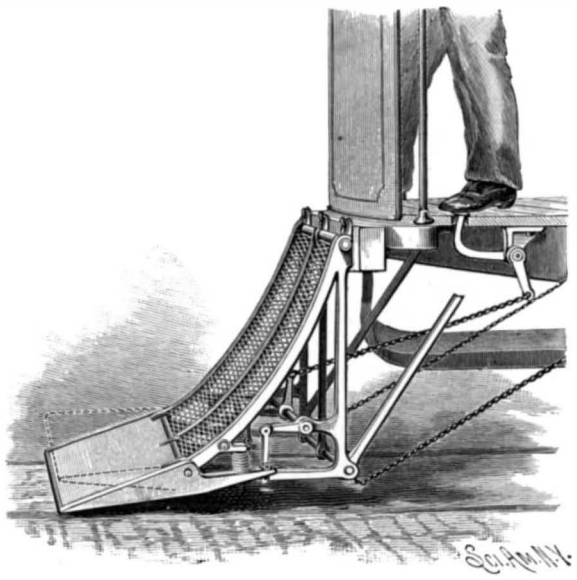
This machine, which forms the subject of a patent recently issued to Mr. Albert E. S. Danner, of Newton, Kansas, cuts the stalks as they stand in the field and carries them back in upright position, where they are held upon a low platform, to be conveniently tied into shocks, and then left upon the ground. The knife is held diagonally, close to the ground, and is secured to a forward extension at the right hand side of the platform, where are located guide fingers which automatically accommodate themselves to any irregularity of the rows of corn, the stalks being received by a front series of feeding devices prior to their reaching the knife, so that the stalks do not drag upon the knife when they come in contact with it. A sprocket chain and gear connection with the left hand wheel actuates a transverse shaft by which are operated two vertical shafts carrying each a series of upper and lower crank arms with which are connected rake feeds that carry the stalks backward in the machine. A gathering or shocker frame is adapted to travel over the table and receive the stalks from the sets of feed rakes, the frame being spring-controlled and moving toward the left along the curved railing of the platform as the stalks accumulate, until the platform has been completely filled, when a keeper on the frame engages a latch to hold the frame stationary. The shock is now ready to be bound, which is preferably effected by a rope or cord having stakes or pegs at each end, to be driven into the ground at the back of the machine. The gate sections of the platform railing being opened, the machine is driven forward and the platform is drawn from under the shock, depositing the latter on the ground. The platform of the machine may be readily raised and lowered as desired, and the front of the machine is raised or lowered and held in position by the manipulation of a lever within easy reach of the driver. The entire operation of the machine is automatic, except the binding and discharging of the shocks.



DANNER'S CORN HARVESTER.

AN IMPROVED FENDER FOR STREET CARS.

This is a fender of simple construction, readily transferred from one end of the car to the other, and having a shoe or take-up section which may be instantly brought down to the surface of the track, to insure the picking up of any object in the way. The improvement has been patented by Mr. William L. Fees, of Avonmore, Pa. It consists of a bracket frame, substantially triangular, with the forward members somewhat concave, this face of the frame being covered with wire netting. At the lower forward portion of the frame is pivoted the shoe or take-up section, which has rear extensions or lips connected by links with arms on a rock shaft, there being also on this shaft a crank arm connected by a chain with an elbow type of foot lever fulcrumed beneath the car platform. Springs hold the shoe normally in a horizontal position, or at a sufficient distance above the track to allow for any unevenness of the roadbed, as indicated by the dotted lines, but the motorman or gripman by pressing upon the foot lever brings the front of the shoe down to the surface of the track, against the tension of the springs, as shown in full lines. The end brackets of the main frame have integral braces, the ends of which are adapted to enter sockets in the under side of the car body, and brace chains or rods may also be employed to connect the rear lower portions of the brackets with the pedestals or with the car body. Along the upper edge of the frame are eyes by means of which the fender may be attached to and hung upon studs or hooks along the upper edge of the dashboard. By attaching a concave plate to the top of the shoe the improvement may be utilized as a snow plow.



FEES' CAR FENDER.

Salted Iron.

A new flux for cast iron has been discovered by Mr. Sentinelli. The compound in question consists of an alloy of sodium and iron formed by bringing iron and common salt into contact at a high temperature. The ferro-sodium so produced contains about 85 per cent of the iron, holding metal sodium in solution, if the term may be used. This latter has a powerful affinity for sulphur and phosphorus, and combining with these carries them out into the slag. The flux may be added either to the cupola or may be placed at the bottom of the casting ladle. The former plan is stated to be preferable. When used in either of these ways the metal in the ladle shows the characteristic yellow flame of sodium on its surface, and its temperature appears to be increased. Indeed, when placed at the bottom of the ladle, the reaction takes place with considerable violence. It is claimed that, by the use of this alloy, the amount of sulphur can be reduced to about one-tenth of its original value, and the phosphorus is also reduced, the cost of the purification being about ½d. per hundredweight.

IN France the population averages about 187 to the square mile. In this country the average is 21 to the square mile.

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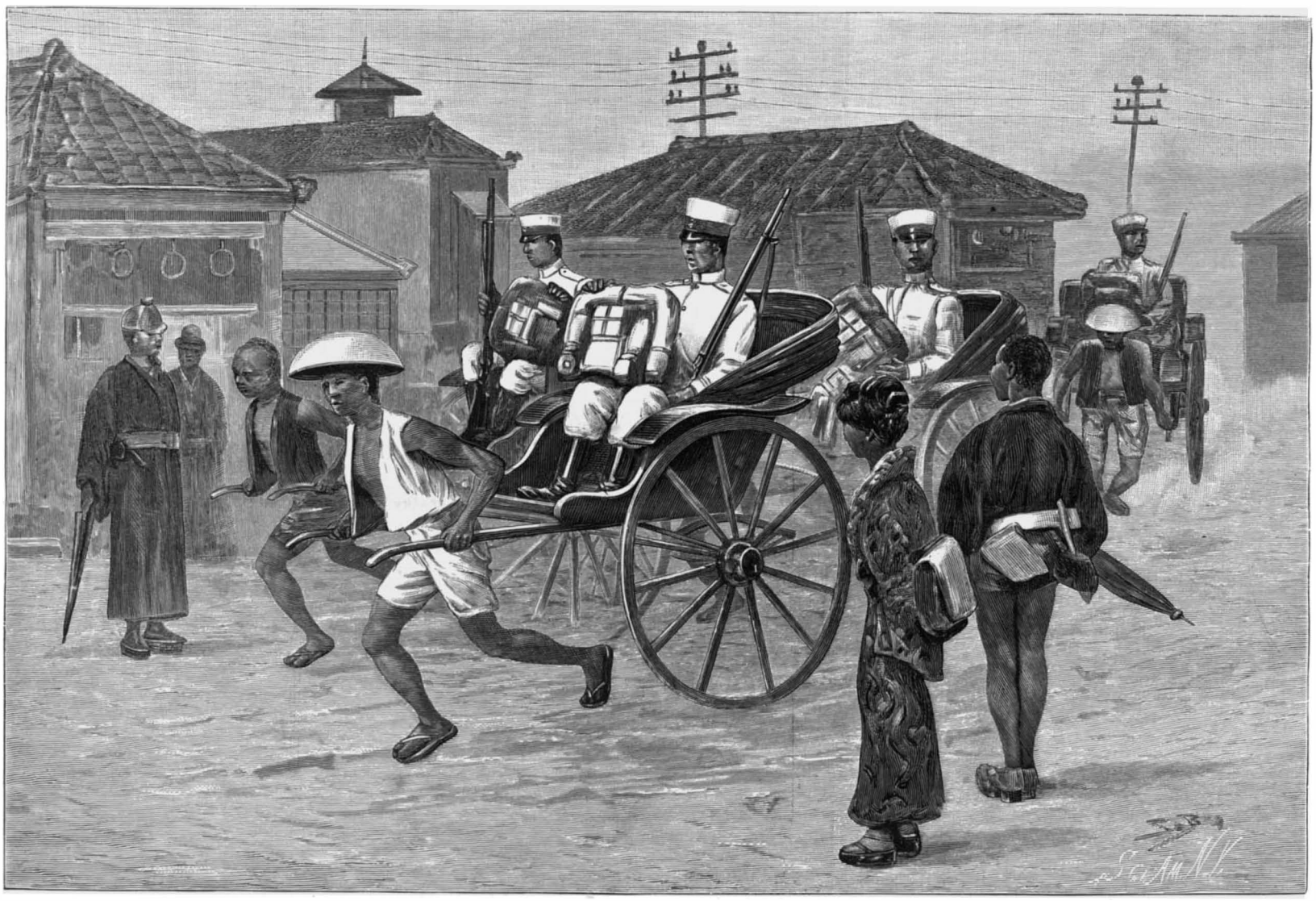
THE WAR BETWEEN JAPAN AND CHINA.

We present herewith one of the characteristic street scenes which have been witnessed daily in Japan during the last few months—Japanese soldiers hastening to the seat of war in China. The vehicle shown is the jinrikisha, a queer-looking conveyance, only used since 1870. It is said they were invented by an American missionary. It is a two-wheeled, hooded conveyance with springs, and is drawn by one or two men, two men being usually employed for fast traveling. On a good road they travel at a speed of about 6 miles per hour. The rate of hire is only about 4 cents per mile.

Japan has achieved a prominent position by her many victories both by land and sea in her war with China. Since the capture of Port Arthur, the great naval and military depot of China on the northerly side of the entrance to the Gulf of Pechili, on November 21, 1894, one army corps has been steadily advancing northward, on the Manchurian route toward Pekin, while another, with the co-operation of the fleet, has been making preparations for attacking the great fortress, or series of forts and naval station, constituting Wei-Hai-Wei, which guards the southerly side of the entrance to the gulf. The attack on the latter place began in earnest on December 26, by land and sea, the defense being more spirited than any that has yet met the Japanese advance, and being most actively participated in by the Chinese war vessels, torpedo boats, etc. Operations were greatly interfered with by the prevalence of extreme cold weather, and progress was impeded by the fact that many sunken mines and torpedoes had to be removed from the harbor and approaches, or rendered harmless, by the advancing Japanese. The latter, however, kept steadily at their work, and the several forts which constituted the great station have steadily fallen before continued attacks of the combined land and sea forces. The major part of the Chinese navy, including the two principal ironclads, the Ting-Yuen and Chen-Yuen, has also been destroyed. They were both engaged in the great battle at the mouth of the Yalu River, from which they escaped only to be sunk at Wei-Hai-Wei, after about ten days' almost continuous fighting, by the torpedoes sent against them by the Japanese. They were sister ships, and the most powerful vessels in either the Japanese or Chinese service, each having a displacement of over 7,000 tons and belted 14 inch steel compound armor. It is reported that the Chinese torpedo fleet subsequently attempted to escape from the harbor on February 7, but that they were pursued by a flying squadron of Japanese vessels and twelve of them either sunk or driven ashore.

The maneuvering of the Japanese fleet at the battle of the Yalu showed that the Japanese admiral was possessed of a knowledge of tactics that would have done credit to a Nelson. A number of the officers of the Japanese navy studied at Annapolis. The armies of Japan are well equipped, and the military hospitals provided with all the latest surgical appliances. For our engraving we are indebted to La Ilustracion Espanola y Americana.



JAPANESE SOLDIERS HASTENING TO THE RENDEZVOUS.

Bicycle Riding.

The average duration of cycling enthusiasm among the ordinary riding class is three years. The first few months are spent in wobbling around on the pavements, eyes fixed and staring, elbows (and knees for that matter) akimbo, coat-tails dragging on the wheel or fluttering to the breeze. After the first muscle-ache stage has passed we find the enthusiasm augmented to ecstasy, like to that of a child in a swing, and speed and distance seem limitless. Then the country road, and the happiness is supreme. Not only are the senses pleased, but the whole organism rejoices in a condition of physical beatitude. That newly described sense, the muscle sense, contributes its share in this expression of well-being. The locomotor apparatus of man craves exercise as the stomach craves food, and the gratification produces similar good feeling in the respective organs. But such exercise! Clad in porous wool, the whole body is as it were swimming through a sea of oxygen, breathing at every pore. A speed of ten miles an hour means augmented atmospheric pressure of three or four pounds on the ventral surface and corresponding decrease of a few pounds below normal pressure on the dorsal surface. The whole spinal tract is thus subjected to pneumatic suction and its circulation thereby stimulated. These are all factors in the spirit of exhilaration experienced by judicious riders. And the cold sponge-bath on reaching home, without which no exercise can contribute its full quota of good, is looked forward to with quite as much zeal of anticipation as is the hearty meal (in waiting).

Now our amateur has reached that condition of development of the special wheeling sense enabling him to adjust himself to the conditions of moving equilibrium automatically, even under very trying conditions; he can endure several continuous hours in the saddle without fatigue, and his great thigh muscles have developed to meet the demands. The ordinary rider has, in say one year, reached the limit of development. If he loves riding because of the physical pleasures, and drinks in the beauties of nature as he speeds over the country, you will find that he never rides solely for distance record, but for real pleasure, and hence does not go beyond his capacity.

But too many ride for the excitement, and their pleasure is in boasting of miles covered. These latter are the three years' enthusiasts. They know almost nothing of the real pleasures of cycling and their enthusiasm is shortlived.

Just a few words as to the saddle about which the laity are exercised. Experience proves that a firm, almost springless saddle, very narrow at the pommel, and sloping backward so that the weight is received on the tuber ischii, is the least harmful. On the country road one finds a rider thus mounted poising his body delicately on three points of support, viz., handle bars, saddle and pedals. He is never jarred and his extremities or buttocks never grow numb. While we thus advocate the three-point support, we emphatically protest against the scorcher position and especially for young boys. There is no use trying to tell an experienced road rider that he must sit erect. He will tell you that it cannot be done, and will retort by saying that more harm is done to the perineum by erect posture than by the slight forward inclination of the body.

Now for a curtain lecture to the doctors. Ride a wheel for your health. This implies that not all need it. Dress for wheel riding, and don't let your dignity coat-tails fly to the breeze like a jay. When you ride dress accordingly, and try and look trim and carry yourself gracefully. Dignity does suffer when the professional or other gentleman goes paddling along with pantaloon wings sticking out at ankles, knees hitting handlebars, and everything above the seat flying loose. To ride gracefully means to ride with a minimum of discomfort and fatigue, and if one cannot acquire that art without instruction, by all means go to a training school. The profession should set a good example in this as in all other matters pertaining to physical development.—The Toledo Medical and Surgical Reporter.

Decomposition of Glass by Water.

From a long series of experiments of his own on these subjects, and from the work of others, the author draws the following conclusions:

1. The weathering of glass is caused by the decomposing action of the atmospheric moisture. The carbonic anhydride of the air does not act directly on the glass, but only on the alkaline products of the aqueous decomposition.

2. Dry carbonic anhydride is without action on dry glass.

3. There is no proof that water can be retained by glass, except when it enters into chemical combination therewith.

4. The weathering of glass and the decomposition of glass by water are similar processes, and are both preceded by the taking up of water into the glass molecule.

5. The surface changes caused by weathering are comparatively slight with good glass.

6. The action of water on weathered glass is only temporarily more rapid than it is on new glass.

7. Glasses (lime glasses) are more hygroscopic and weather more easily, the more easily they are attacked by water.

8. Even after long action of water, glass is still capable of becoming weathered.—F. Foerster.

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New French Steamers.

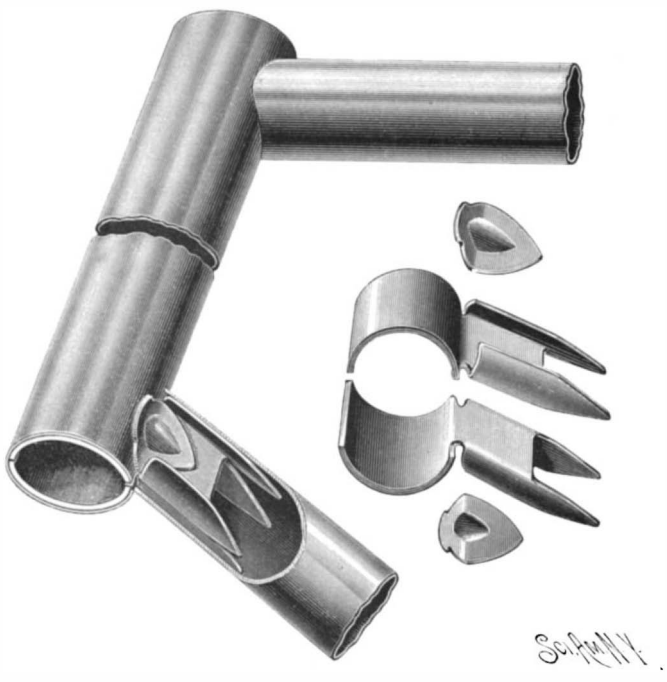
Arrangements are said to be well advanced for the construction of two new French Transatlantic liners. These new vessels, which will come next to the latest Cunard liners Campania and Lucania in point of size, are, it is stated, to be named Alsace and Lorraine. The new steamers are to be 557 ft. 9 in. long and 59 ft. beam, and at 26 ft. draught the displacement will be 13,600 tons. Now the Campania is 600 ft. and 65 ft. beam, while the American liners are 527½ ft. and 63 ft. beam. The Alsace and Lorraine are larger than any non-British steamer. They will have a sea speed of 20 knots, but it has gone forth that they are to beat the Campania and Lucania in ocean steaming. The cost is put by the French Transatlantic Company themselves at from $3,750,000 to $4,000,000, and the company have approached the government with the view of securing some guarantee of financial return in the future. They point to the advantage of such vessels as auxiliary cruisers, apart from commercial gain, and seek directly, as compensatory guarantee, that the government should rearrange the service from Havre and Bordeaux to Colon, giving the company a 10 years' concession. On this route two of the present Atlantic steamers would be placed to make Guadeloupe 8½ days distant from Bordeaux, Port of France 9 days, Cayenne 13½ days, and Colon 14 days. This is equal to an acceleration of three sea miles per hour on the present service, and the advantage to French colonial trade would be appreciable.

A NOVEL BICYCLE FRAME.

A new feature in bicycle construction is being introduced involving the method of connecting the tubes of the frame. The system of construction is protected by patents of Charles O. Barnes.

The connections, as shown by the accompanying sketch, consist of two punched and formed-up pieces of 18 gauge steel arranged to extend around the inner side of the head tubing until they meet, and at the same time both projecting from the tube at the desired angle to form a circular stud over which the connecting tube can be fitted and brazed in position. Small angle pieces are added, as shown. The pieces used in this manner act as a re-enforcement to both tubes, and being pointed off in the smaller one, obviate any possibility of crystallization and breaking of the tubes. The usual method of connecting the sections of the frame is by drop-forged outside pieces, which are necessarily much heavier and make the frame look more cumbersome, while with the Barnes method the connections are all on the inside, thus relieving the frame of any outside projections.

Another important feature of the new Barnes bicycle is the method of adjusting and holding the handle bars and the seat post. In the case of the former there is a small hexagon cap screw on top of the bar which constitutes the only outside appearance of the fastening. When the handle bars are raised to the desired height, the tightening of this cap screw draws a circular wedge up inside of the handle bar post, which, being slotted, is expanded and held firmly in position. The seat post is adjusted and secured in a similar manner.



FRAME CONNECTIONS AND RE-ENFORCEMENTS OF THE BARNES BICYCLE.

It will be seen from this description of the novel features that it has been an object to as far as possible relieve the machine of any outside projections and drop-forged frame connections.

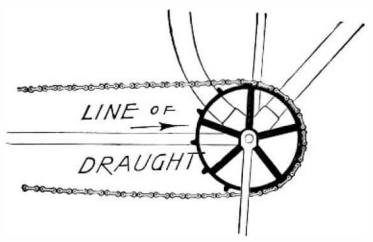
A company to be known as the Barnes Cycle Company has recently been organized for the manufacture of this wheel, and has fitted up a large factory at Syracuse, N. Y., for that purpose. The company has gone into the business on a large scale, and intends to build only high grade bicycles, using tool steel cones and ball cases and the best material obtainable throughout.

KEATING BICYCLE.

The Keating bicycle, manufactured by the Keating Wheel Company, Holyoke, Mass., claim to have been the first to put on the market a fully guaranteed light weight roadster. They have in past years placed upon the market the following weights: 35, 32, 25, 21; and

THE KEATING BICYCLE FRAME.

finally for the present year a 19 pound wheel has been produced. To those interested in wheeling this is an interesting bit of history, and it does not seem likely that a road wheel can be made much below the last named weight. The Keating wheel is characterized by a special shape of frame with a very long wheel base, 45 inches, and narrow tread, by straight tangent spokes, convertible pedals and dust-proof bearings. The frame possesses as its distinguishing peculiarity a curved center brace, shown in the two illustrations annexed. The idea of this is not only to bring the rider to a better position with reference to his work,



THE KEATING CRANK BRACKET AND CONNECTIONS.

but to give a greater resistance to the draught of the chain upon the frame. This draught is resisted by the bent portion of the center brace, avoiding a transverse strain, and we find in this feature one of the few original features of the frames of the year.

Like other high grade wheels, it uses the finest crucible steel for the hubs. In all respects and details it is highly characteristic and is pre-eminently a wheel of original construction. For ladies, both drop frame and diamond frame wheels are made, the latter weighing but 19 pounds and being designed for rational costume. This wheel, the company states, is the only one supplied to the European trade. The drop frame ladies' wheel weighs 4 pounds more. They also make for ladies the straight tube drop frame. All their wheels are absolutely guaranteed for a year.

One of our cuts shows the diamond frame, the other shows the crank bracket connections on a larger scale.

The Paris New Sewer Main.

The new sewer main of Paris, which crosses from Clichy to Asnieres underneath the Seine, was formally dedicated recently. It is the first portion of an enormous enterprise which will take away all the sewage of Paris from the waters of the Seine. The work was begun in 1889, and will require fourteen years or more to complete. The difficulties encountered, especially under the river proper, were many and took a long time to overcome. The river, forming its bed in remote times, upheaved the soil for a considerable depth. Crevices filled with alluvial matter, quicksands, calcareous rocks, conglomerates and very hard silex were met within a few feet of each other. The machinery employed is similar to that used in America with great success at the St. Clair tunnel, namely the Beach Hydraulic Tunneling Shield, an American invention now generally used throughout the world for earthwork tunneling. As quick as the shield advanced, the huge iron rings forming the tube were adjusted. The length of the tunnel under the Seine is 1,543 feet; its diameter, 8 feet 6 inches. Another highly interesting subaquatic structure is the Mersey tunnel, connecting Liverpool with Birkenhead. It is 10,660 feet long, 26 feet wide and nearly 20 feet high. The drainage is performed by a sewer as long as the tunnel itself, ending in a pit on either side, wherefrom the water is raised by pumps having a capacity of 6,000 gallons per minute. The ventilation is very effective; a duct connected with the main tunnel by slanting shafts leads to a large fan wheel above, which draws all smoke, gas, etc., out of the tunnel, while at the same time fresh air is forced below.

Alkaloids of Cacti.

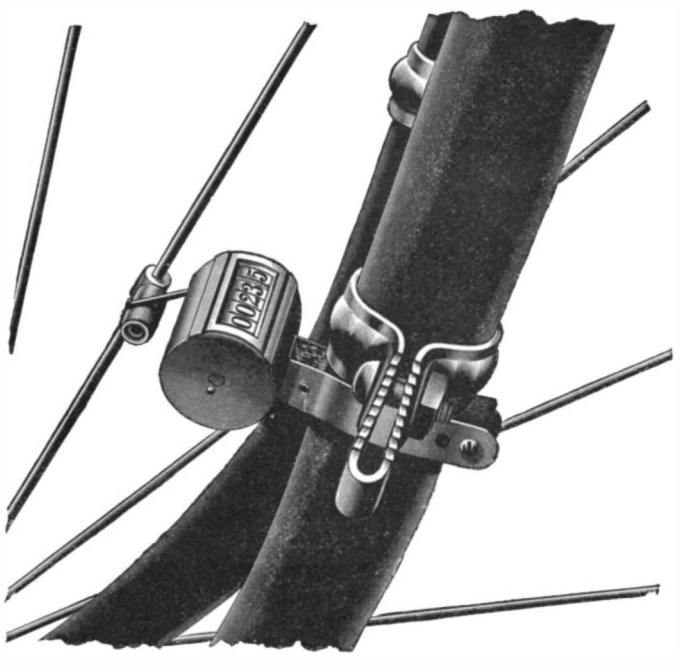
Before the Physiological Society, Berlin, Prof. L. Lewin gave an account of some experiments made with an alkaloid obtained from a North Mexican cactus called "Peyotl." It is well known that this plant has an intoxicating action, and in large doses produces sleep and a state of nervous excitation accompanied by a so-called "power of prophesying," similarly attributed to the sulphurous exhalations of the temple at Delphi. Small doses of the alkaloid when given to frogs produced tetanic cramps and a much increased reflex irritability, analogous to strychnine; but with this difference, that by carefully apportioning the dose the effects were permanent for several days. Similar results were obtained with rabbits, and Prof. Lewin regarded the new alkaloid as specially adapted to further the study of the nature of tetanus. In rabbits it was noticed that during each paroxysm of cramps, the blood vessels of the ears were widely distended. The speaker had also found alkaloids with powerful actions in many species of cactus hitherto regarded as harmless by botanists, notably one closely resembling curare.

THE U. S. CYCLOMETER.

The U. S. Bicycle Cyclometer, a cut of which accompanies this article, is a very compact and light one—lightness being a sine qua non with wheelmen of the present day. It weighs one ounce, is one inch long and seven-eighths inch in diameter. Its registry terminates at 10,000 miles, and it can be set back to zero or other figure at any time. As shown, it is attached to the front forks so as to be read from the saddle. To facilitate this, the figures are arranged in one straight line, the extreme right hand figure giving tenths of a mile. The instrument is shown in the cut as reading $23\frac{5}{10}$ miles. It is attached to the front fork by a thin clamp, so that, if hit by anything, it has a good chance of escaping injury. Instead of glass, mica is used to cover the face of the figure drums. This obviates danger of breakage, conduces to lightness, and the mica, if injured, is easily replaced. Phosphor bronze is used for the wearing parts and the case is German silver. This makes it practically water-proof. If any dust should get into the case, it settles to the bottom, out of harm's way.

It is accessible for repairs or cleaning by removing one end of the case, when the whole movement comes completely out. The simplicity of the mechanism makes it easily cleaned.

Each cyclometer is tested by being run to a 400 mile registry, at a rate corresponding to 50 or 60 miles an hour. They are made for 26, 28, and 30 inch wheels, and by changing one piece, at a nominal expense, the same instrument can be standardized for any size of wheel. In the cut, the cam attached to one of the spokes of the wheel is shown as it is on the point of moving the cyclometer arm.



THE U. S. CYCLOMETER.

This cyclometer has been patented, and is manufactured by Bean & Lang, Fond du Lac, Wis.

Varnishing Metal.

The objects are dipped in a colorless pyroxylin varnish and then heated in a current of air at 80° C. until the varnish is thoroughly dry, when they are immersed for a few seconds in a two per mille alcoholic solution of alizarin, followed by a wash in water, to change the color from the original light yellow to a golden red.

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THE LATEST LONG DISTANCE TELEPHONE TRANSMITTER.

(Continued from first page.)

The magneto machine and polarized bell are of the usual construction, the magneto having an automatic circuit closer which closes the circuit between the line wire extensions when the crank of the machine is turned. The resistance of the polarized bell is very high, so that its insertion in the circuit in the manner shown in the diagram is feasible.

When the telephone switch is up, as shown in the diagram, a switch arm forms an electric connection with the two springs, as shown, but when it is held down by the weight of the telephone, the contact is broken between the lever and springs. The battery used in connection with the long distance transmitter consists of two Fuller cells. This battery has been frequently described in these columns.

THE BLAKE TRANSMITTER.

DETAILS OF CONSTRUCTION.

As the patents on the Bell telephone receiver and Blake transmitter are no longer in force, the general use of the telephone is likely to be greatly extended.

The thousand or more uses the telephone can be put to and its manifest convenience in rapidly transmitting messages make it the most remarkable time saver the world has ever known.

The Blake transmitter has been, in a measure, discarded by most of the telephone companies, not because of any special defect, but because there cannot be safely put through the transmitter enough current for transmitting sounds over great stretches of wire, say three hundred miles or more. But with a modern copper metallic circuit, with the battery in normal condition, it can be worked successfully on lines 150 miles long. It has the merit of reproducing the voice very distinctly and with a naturalness of tone and amount of volume that is surprising.

For these reasons it is regarded by experts as one of the best forms of microphone made. It took a long time for all the niceties of adjustment and little points of manufacture necessary for its perfect working to be ascertained.

We show in the two illustrations the general appearance of the Blake transmitter (Fig. 1) and a diagram of the connections (Fig. 2). The external dimensions of the box, referring to Fig. 1, are 5¼ × 4¼ × 2¾ inches. The square frame of the box is ⅜ of an inch thick and the cover and back are about ¾ of an inch thick. The diaphragm aperture in the cover is ⅝ of an inch in diameter, while the diameter of the cup-shaped mouthpiece formed in the cover and converging to the central opening is 1⅝ inches in diameter. To the rear of the door is secured the cast iron circular ring, A, inside of which lies the Russia iron diaphragm, B, 2¾ inches in diameter, 2-100 inches thick, or No. 24 B. & S. gauge, enveloped at its edge with a Goodyear pure rubber band, Z (Fig 2), 2½ inches long by ¾ of an inch wide, such as can be purchased at any rubber goods or stationery store.

A seat ⅜ of an inch wide, 1-16 of an inch deep, and a little larger in diameter than the diaphragm, is formed in the iron ring. On this seat the diaphragm rests. A short, thin metal plate attached to the ring, A, on the right hand side clamps the diaphragm in position. The plate should rest squarely on the rubber edge of the diaphragm, holding it firmly against the ring. Its function may be described as being like that of a hinge, which allows the diaphragm to freely swing inward. The diaphragm should be perfectly flat and true, and all parts of its edge should rest easily or touch all portions of the seat. The steel damping spring secured to the ring at the opposite edge of the diaphragm is protected at its free end with a rubber glove on which is cemented a thin piece of fluffy woolen material. This spring extends to a point about half way between the periphery and the center of the diaphragm. It is 1½ inches long by ⅜ wide, and is bent with quite an arch, so that the end will press, finger-like, firmly upon the diaphragm. The function of this spring is to prevent excessive vibration. Once in six or eight months the spring should be removed and the fluffy end roughed up. About once in six months the rubber band should be removed from the diaphragm and a new one put on.

Referring to the iron circular casting, A, it will be observed that it has at the bottom a projection holding an adjusting screw, and to a similar top projection is attached by screws a brass spring, about No. 16 B. & S. gauge, from which depends another casting, C, in Fig. 1, and T, Fig. 2, supporting the complete microphone apparatus. Fig. 2 shows this portion separated from the supporting casting, A.

Referring to Fig. 2, A is one terminal of the primary battery passing by wire, S, to the hinge, H, to which it is soldered. From the other leaf of the hinge the wire, M, insulated and protected by a rubber tube, passes to K, where it is soldered to the upper end of the German silver spring, I. The spring, I, is ⅛ of an inch wide. At K this spring is clamped between two pieces of hard rubber and is thus insulated from the iron work. In the lower end of spring I is bored small hole in which is inserted and soldered a bit of No. 18 platinum wire having each end rounded off, forming a bead, one side of which is in contact with the diaphragm, N, the other side contacts with the carbon button, J, details of which will be given. Numerous experiments demonstrated the necessity of giving to the spring, I, a special curve in order to get the best results. The curve should follow as closely as possible from the point of support downward, an arc of a circle seven or eight inches in diameter, but it must not touch the diaphragm. When the button, J, is pulled back, away from the diaphragm, N, the spring, I, should follow it in contact from ⅛ to 3-16 of an inch before separating. The carbon button, J, is supported by a small brass weight attached by a small screw to a piece of watch spring, R. This spring which is straight is clamped in metallic contact at its upper end with the metal support, T.

It is surrounded its entire length with rubber tubing to deaden any possible vibrations in the spring itself. The brass weight which holds the carbon button, J, is beveled outward, with its periphery milled, in order that it may be easily rotated for adjustment on the screw which holds it to the spring, R.

The proper way to polish the carbon button is not generally understood, and as the smooth looking-glass polish is one of the essentials to good articulation, we will describe the most approved method of producing it. The button is taken off its support, R, by unscrewing the screw in the back. A piece of the finest crocus emery paper, about two inches square, is placed upon some firm support and held flat by the two fingers. The button, held between the thumb and finger, is next placed, carbon side downward, upon the emery paper and rubbed over it in the space of an inch circle. At first the surface of the button is roughened, but as soon as the paper becomes filled with particles of carbon or is blackened, the polish begins to come. At this stage the sweep of the button is reduced and confined to the center of the sheet and a slight gyratory motion given to it; at the same time the button is rotated on its axis with the thumb and finger, half a revolution, then half a revolution in the opposite direction, the principle being that the fine carbon particles rubbing in contact with the surface gives the final gloss.

The whole operation requires less than five minutes, and it is surprising how easily and beautifully the high polish is obtained. After it is done, the emery paper is turned over and the button rubbed slightly on the back of it, to remove the loose particles of carbon from the surface, then the button is returned to its place in the transmitter, and the point of the platinum bead pressing against it is burnished by rubbing a knife blade over it.

The transmitter is adjusted by turning the screw, O, to the right or left, the tapered upper end of the screw engaging the beveled end of the casting, T. That is, the pressure of the button and platinum bead against each other and the diaphragm, N, is increased or decreased by manipulating the screw.

One of the guides in determining the right microphonic effect is to place the butt end of a lead pencil in contact with the outer face of the diaphragm, then slide the fingers gently along the pencil toward the diaphragm, listening in the meantime in the receiver. If this sound is readily transmitted and heard, the transmitter is considered quite sensitive. Having traced the circuit through the platinum, spring, and carbon button, where the spring holding the latter comes in contact with the iron support at K, the circuit continues from the iron ring, as shown at L, to the lower hinge, G, thence by wire, P, to the interior of the induction coil, usually consisting of two coils of No. 16 wire, and called the primary coil; see F. From the top of this coil it passes to the second binding post, B. The resistance of this coil is very small. The secondary wire, E, on the outside of the induction coil consists of several layers of No. 36 wire, having a resistance of 150 ohms; the terminals, X and W, are carried to the two posts, C and D.

The posts, A and B, are connected to the battery, which should have a voltage averaging from 1 to 1·6 volts. If it falls below a volt the microphone will lack snap, and will not transmit as loud. One average Leclanche cell is sufficient, or one cell of a dry battery like the Mesco.

If all the foregoing details are carefully observed, the transmitter will be found to meet the most exacting requirements; it can be shouted at without getting out of order, as we know by actual experiment.

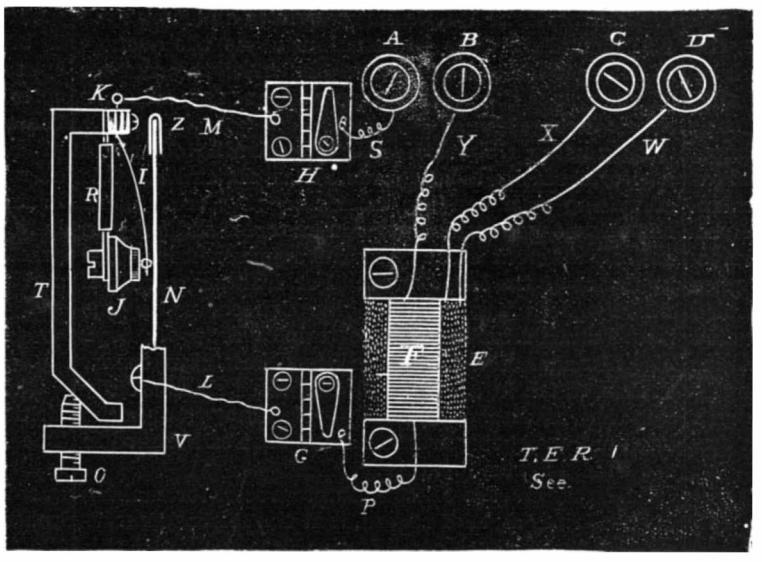

FIG. 2.—Internal Construction of the Blake Transmitter.

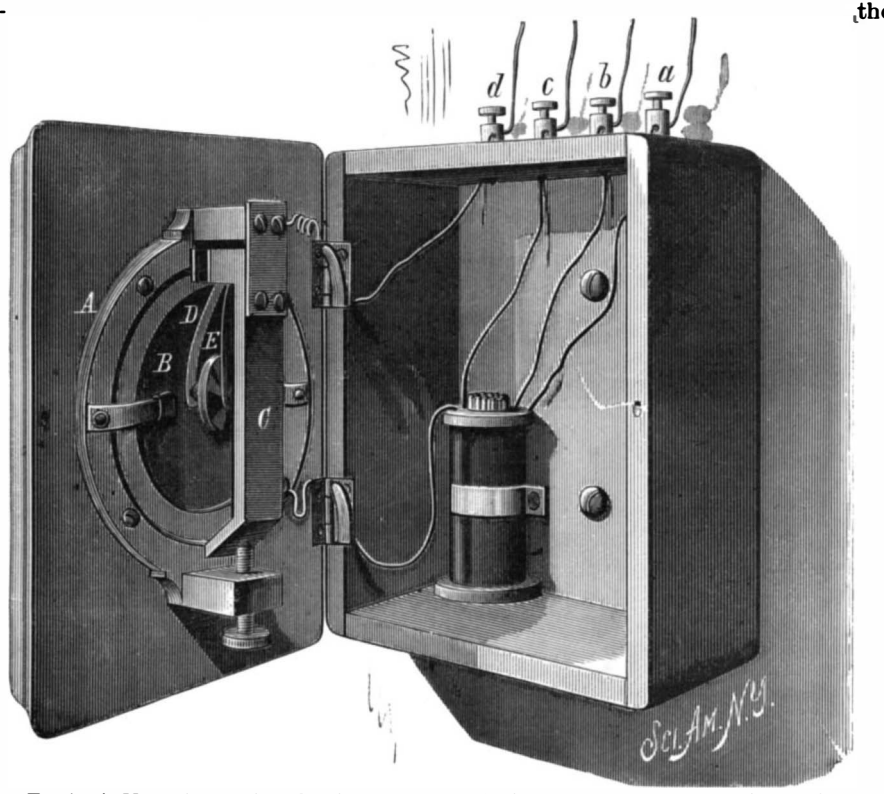

FIG. 1.—A. Metal circular ring. B. Diaphragm. C. Adjusting angle bar. D. German silver spring. E. Carbon button spring. a b. Secondary wires. c d. Primary wires.

THE BLAKE TRANSMITTER.

Removing Impurities from Wools.

For above purpose (according to the process just patented in France and England by C. Delerue, of Roubaix, France), the wool sliver is fed by feed rollers in between a pair of cylinder brushes, and from them it is removed by a rapidly revolving comb in contact with which there is a more rapidly revolving cylindrical brush with a tapered casing, having an opening through which part of the periphery of the comb projects to meet the brush. By the current of air caused by the rapid revolution of the brush, the wool stripped by it off the comb is projected toward the small end of the casing, where it is caught by a pair of hollow wire gauze cylinders, and by them delivered to a pair of feed rollers to be again subjected to the action of a cylindrical comb and brush. These wire gauze cylinders, feed rollers, and combs, and the brushes and their casings, are repeated eight or ten times in the machine, the wool passing in succession through them all.

Cement Mortar.

About eight parts of furnace ashes, slag, or coke, four parts of slaked lime, and one of clay, are taken and mixed dry so as to form a cement, which, on mixing with water, sets in the ordinary way. The proportions of the materials may be varied so as to produce either an aerial or hydraulic cement.

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The Siberian Railway.

The works in connection with this large undertaking are being pushed ahead with the greatest energy, under the auspices of the young Emperor, who intends to retain the presidency of the Siberian Railway Committee. According to Engineering, there is reason to believe that the West and Central Siberian Railway will be ready by the year 1900. What is called the Baikal Ring Line will not be commenced till the other sections are taken in hand, but it is expected to be completed by about 1904. The Baikal Lake will in the meantime be used for the transport of railway material for the Trans-Baikal section, from Myssonskaza to Stretensk. This section has an aggregate length of 680 miles, and on it a great number of engineering difficulties have to be overcome. The district through which the railway is to pass is very thinly populated, there are many mountains and elevated plateaux, and the climate is very severe, the soil being at all times frozen. The highest point which the railway will touch on this section is about 3,200 feet above the level of the sea. On the railway lines referred to, there will have to be built the immense number of 973 bridges. The longest of these is the Selenga Bridge, which will be about 3,000 feet long; for comparison's sake, it may be stated that the large Grunthal Bridge over the North Sea-Baltic Canal is only 620 feet. It was originally under contemplation to use wood as bridge building material in some places, and to use steam ferries at others, but both these plans have been abandoned, although this alteration will entail an additional expense of about 25 per cent upon the originally calculated cost. Stretensk is situated at the Shelka River, which is an auxiliary to the Amur River. The connection between Stretensk and Chabarowka, a distance of some 1,300 miles, will, in the meantime, be carried out by steamers. At Chabarowka, which is situated at the entrance of the Usuri River into the Amur River, a bridge will have to be built of 7,700 feet length, which is more than two and one-half times the length of the Strelenka Bridge on the Central Siberian section.

The last large section of the Siberian Railway will connect Chabarowka with the naval port of Vladivostok. One-half of this section, from Vladivostok to Grosskoia, will be ready in the present year, and the second, from Grosskoia to Chabarowka, a distance of some 230 miles, has to be ready in the year 1898. The headquarters of the West Siberian Railway are at Tschetjabinsk. The section which comes under this management terminates at the bridge over the River Ob, which bridge has a length of 2,600 feet, and is situated at Kriwoschtokowa. This section should be completed in the year 1896. The headquarters of the Central Siberian Railway are at Tomsk. Each section is divided into sub-sections of about 85 miles length. For about every 20 miles there is an engineer, with assistant engineers. Next year a large number of convicts will be employed in the building of the railway, and so as to remove any inducement to try to escape, they will obtain the same pay as the free laborer, and when the railway is completed half their term will be wiped off. The proper earth and bridge building works can only be carried on during the period from May to about the middle of October.

The Typewriter Ribbon Industry.

The manufacture of ribbons for typewriting machines is an industry which gives employment to a large number of people. On nearly all the first-class typewriters these inked ribbons are used. There are at least forty different styles of American typewriters, and more than 400,000 machines are in actual use. As the average life of a ribbon is from four to six weeks, the number of concerns which seek to supply the market with this article is surprising.

They make ribbons of every conceivable color and variety, from six to ten yards in length, and capable of writing with copying or non-copying ink. Some ribbons are made which print in one color and show an entirely different color when the manuscript is copied by means of the letter press. For instance, a ribbon which writes black may copy blue or green, making the record much more legible on certain qualities of paper. The manager of a concern in New York, says the N. Y. Sun, which turns out several hundred ribbons daily said that, at a low estimate, fifty plants engaged in the manufacture of these ribbons have been established in the United States this year.

Each manufacturer has a secret process for making his particular style of ribbon, and the secret is guarded with the greatest possible care. One maker in this city has each box and jar containing powder or pigment for making the ink distinctly numbered, and even the employe who mixes it is obliged to follow his printed instructions mechanically, and remains entirely ignorant of the composition he is using. One may witness the whole process and go away as ignorant as before.

The best ribbons have selvaged edges, which prevent their raveling and curling when in use. They are nearly uniform in thickness, though one ribbon is made of very thin texture, to be used when an extra large number of carbon copies are desired, and the imprint of the type must be as clear as possible and free from blurs. The greatest care must be taken in selecting the cloth from which the ribbons are made. If the texture is woven too closely it will not hold sufficient ink, and smirch the paper. Moreover, such a ribbon will fill the type of the machine and greatly annoy the operator. A prime difficulty encountered by manufacturers is how to prevent evaporation of ink from the ribbon when it is in use and exposed to the air. This has been largely overcome in the last two or three years.

The man in charge of a large New York house which makes writing inks and typewriter ribbons said recently that the most noticeable thing in his trade was the great decrease in the sale of ordinary copying ink. It is being almost entirely supplanted by the copying typewriter ribbon, which gives far better results. Despite the great number of ribbons in the market and the constant efforts of expert chemists everywhere to produce one that will satisfy everybody, those giving all-round satisfaction are not easy to find, and dealers in supplies of this nature often have extreme difficulty in furnishing what is wanted. This country furnishes practically all the typewriter ribbons in use both here and abroad.

A Steamer Makes Thirty-three and One-half Miles per Hour.

The Boxer is the last torpedo boat built for the British Admiralty. She is the last of four fast boats. The Boxer is 201½ feet long, 19 feet beam, draught loaded 7 feet 2 inches. On a recent trial the mean speed on six runs over the measured mile was 29·314 knots, or 33½ statute miles, per hour. Her sister boat, the Ardent, made almost the same speed, her engines indicating nearly 5,000 horse power and making 407 revolutions.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CIRCUIT CLOSER FOR RAILS.—Edgar C. Wiley, Bristol, Tenn. This circuit closer is operated by the passage of the train over the rails, thus bending down the rail itself. On the main rail are contacts which are brought together or separated by a friction drag slide, actuated by the bending down and uprising of the rail to both close and open the circuit. Combined with the drag and with the main rail is a supplemental rail, one part of the device being attached to the main rail and the other to the middle of the supplemental rail, the end of the latter rail being anchored to the main rail. In applying the improvement little or no excavation is required, and the devices may readily be placed upon a bridge or other location where there is no foundation of earth.

AUTOMATIC ELECTRIC SAFETY RAILROAD SYSTEM.—Rene R. Snowden and Albert C. Ives, Ocala, Fla. This system is designed to prevent collisions or the running of a train into an open switch; also to prevent more than one train occupying a crossing at a time, and to protect a car left standing on a track from trains approaching in either direction. Each train is provided with a battery and the track forms a conductor laid in insulated sections, while the improvement provides novel trolleys, circuits, switches, and connections with operating parts of the locomotive. The closed circuit is only made when two trains are within a certain distance of each other, and the closing of the circuit is arranged to automatically actuate the steam and air valves of each locomotive to prevent collision.

CAR PLATFORM SUPPORT.—Seth A. Crone, New York City. This is an improved construction by which the car platform is reinforced and strongly supported by braces carried from a point of the car frame in the rear of the end sills. The improvement comprises an angular brace in two independent sections arranged at angles to one another, an abutment supporting the adjacent ends of the sections, and the arrangement being such that a sagging platform can readily be raised and readjusted to its normal position by screwing up nuts.

GARMENT HANGER FOR CAR SEATS.—This is a further invention of the same inventor, providing a device which may be attached to the back of any seat and capable of receiving a very bulky or a very small garment or other article, the device automatically flattening itself close to the seat back when the article is removed. The body of the device consists of a strap controlled by a spring fastened to a spindle in a suitable casing attached to one end of a seat back, the other end of the strap being attached to the back of the seat near its opposite end. The casing, all but its face plate, may be concealed by the upholstered back of the seat. The strap may also be made wider in certain portions and formed to afford pockets.

Mechanical.

THREAD CUTTING BRACE.—Edward L. Barton, Millersburg, Pa. According to this improvement a chuck is adjustably connected with and at right angles to a straight handle, the handle comprising sectional sliding parts engaged by a locking device, and one of the sections being adjustably connected with the crank of the brace. The improvement provides a tool in which any form of die for thread cutting may be held, and the brace with the die connected used as an ordinary brace. It may also be advantageously employed in cutting threads in places ordinarily inaccessible or reached with difficulty.

MOULD AND FLASK FOR CHILL ROLLS.—Alexander McLennan, New York City. This improvement comprises a frame in which a series of single chills is set loosely to form the mould for the roll, the chills being adapted to be moved inward to follow the contraction of the poured metal, and form a tight band around the casting as the metal contracts, thus preventing cracking and insuring a better chill. A truncated cone-shaped ring engages the outer beveled edges of the chills to uniformly and simultaneously move the chills inward as the metal contracts.

COUCH ROLL FOR PAPER MAKERS.—William J. Hoffman, Ancram, New York. In place of the flat covering ordinarily used on the couch rolls of wet machines, this inventor provides a roll covering which consists of strips of felt placed edgewise, and held in place on the periphery of the rolls by binding wires, or the strips may be doubled and inserted in holes in the face of the rolls, as bristles are fastened in a brush back. The spongy surface thus formed does not become hard, is easily applied to the body of the roll, and the rotation of the roll shakes the strips loose, keeping them in good workable order.

SHADE CLOTH PREPARING MACHINE.—William P. Cole, Montreal, Quebec, Canada. This invention provides a mechanism for treating fabrics to be sized or painted, and especially applicable to the making of opaque shades. The fabric is passed from a roll between brushes to sizing and painting tanks, being successively dried, brushed, and trimmed, while held very tightly, so as to take out all the stretch, until it is finally delivered in a compact, finished roll after having been passed through the machine. The brushes smoothly spread the size and paint and remove all surplus material, the entire operation being automatic.

DIGGER.—Albert Roll, South Amboy, N. J. This is a construction which, with an operating engine and elevators, is designed to be carried and operated on a flat car. It comprises a rotary digger with a series of pockets adapted to scoop up dirt or other material, its central hub secured to a driving shaft and provided with circumferential pockets open at their outer ends, so that the material carried to the upper side runs into a spout to be delivered to the elevator or carrier. The digger is particularly adapted to scoop up coal out of a pile and facilitate loading it upon a car.

TIE FOR WIRE STRUCTURES.—Eugene L. Williams, Jerseyville, Ill. This tie is formed from a staple whose two members are differently curved in order that the staple may fit snugly in the dies of a machine for effecting the tie when the staple is bent to a ring-like form, the members being also beveled at their extremities upon opposite faces. The tie thus formed is light and strong and ornamental in appearance.

Miscellaneous.

CALCULATOR. — Charles S. Labofish, Troy, N. Y. This calculator may be made in the form of a watch, to be carried in the pocket, operates without keys, is not liable to get out of order, and is adapted to perform the various operations of addition, subtraction, multiplication and division. Its case has circumferential sight slots, and around a central driving gear is arranged a series of number wheels, the stem having a revoluble crown head, by turning which the calculator is operated, there being an operative connection between the stem and the gear wheel. The number wheels represent units, tens, hundreds, etc., and the wheels to be moved are pressed inward by pushing a button which projects through the shell of the case.

TELESCOPE, MICROSCOPE, AND CAMERA.—Robert L. Stevens, Ward, Pa. This is a combination instrument, with improvements arranged upon and forming a part of an ordinary pocket telescope, the several telescopic draw members, except the inner or eye section, being arranged and joined in the usual manner. In the inner section may be a single lens or eye piece or a number of microscopic lenses, the inner section being preferably somewhat longer than usual, to be extended outward and provide a supplemental portion in which a slide may be inserted through a slit, thus providing an effective microscope. The slit may also be provided with a pair of apertured diaphragms in which a sensitized plate may be inserted, and the instrument then employed as a camera.

POCKET MAP.—A further invention of the same inventor provides a combined microscopic and photograph map holder for travelers, bicyclists, etc., to be carried in the pocket as an ordinary watch, the maps being interchangeably held, and the vision or focal point being moved over the map to any desired point. The casing has a series of lenses, disconnected at their focal points but joined to form a consecutive whole at the opposite end, there being provision for holding a translucent map on the joined end of the lenses, while in connection therewith is arranged a map-holding casing.

SEWING MACHINE.—Walter G. Tillou and John W. Clapp, New Haven, Conn. This improvement relates especially to leather-sewing machines, and provides means whereby the stud moving in the feed bar operating lever to communicate laterally reciprocating movement will work within the bar without creating inconvenience in its slideway. The driving cam of the feed bar operating lever is also so constructed that its race will be wider at one point than another, enabling the feed bar operating lever to be carried a certain distance to one side by the haft of the needle when fine stitching is being done.

SEWING MACHINE SHUTTLE.—Walter G. Tillon, New Haven, Conn. This improvement is also especially applicable to machines for sewing leather, the beak of the shuttle being so constructed that it will draw down less thread than the old form of shuttle, and will require a loop of less size through which to pass. It is designed also to so shape the forward bottom portion of the bobbin chamber of the shuttle, near which the loop drawing hook of the machine has play, that the hook may travel very close to the shuttle without touching it, and so that, in the event of any accident to the hook, no damage will be done to the shuttle.

PREPARING GLUE STOCK FOR BOILING.—Edward R. Hewitt, New York City. Instead of following the old and common method of neutralizing lime in glue stock by the action of carbonic acid by drying in air or hanging in baskets in a running stream, whereby some alkali is generally left in the stock, which consists in treating the limed stock first with carbonic acid, and then completing the neutralization of the lime with sulphurous acid, the latter acid preventing decomposition of the stock, while stock so treated renders into glue more quickly than in the presence of carbonic acid.

KNOCKDOWN FURNITURE. — Herman A. J. Rieckert, New York City. This is an improvement on a patent formerly granted to the same inventor, and provides a counter more especially designed for temporary use in stores, on sidewalks, etc., and which may be conveniently folded for storage or removal. The counter has a top made in sections hinged together, a support being connected by hinges with one end of the top sections, and the support being provided with foldable hinged back and sides.

SASH FASTENER.—William F. Sinley, Dingman's Ferry, Pa. This is a lock and support attachment which may be used with either the upper or lower sash of any window and is applicable to all railway car windows. In a recess in a side edge of the sash is a rack whose teeth are adapted for engagement by the spring-pressed bolt of a lock in the sashway or groove in the window frame jamb. The bolt is adapted to be operated by a key always in engagement with the lock, but which may be turned to prevent the sliding back of the bolt when it is desired to hold the sash from any movement up or down, in any position in which it may be placed, the bolt normally slipping by the teeth of the rack as the window is raised.

REIN HOLDER. — David H. Blascow, New York City. This is a simple device which may be placed horizontally or vertically over the dashboard, whether the latter be curved or straight, and may be attached to the board without the use of bolts or otherwise marring it. It has adjustable jaws, and a whip holder may constitute an integral part of the device, and, when in position, it is impossible for the horse, or anyone in front of the holder, to draw or disengage the reins from it.

MANHOLE COVER FOR CISTERNS OR WELLS.—James Fowley, Cobden, Ill. This invention provides an inexpensive cover plate which will also serve as the base or curb member to which the pump casing or stock may be secured. It is made in half sections, having each a pendent lock portion, the sections being adapted to readily fit down over the curbstone opening or other top member of the well mouth.

Designs.

BRACKET.—John J. Hoffman, Denison, Iowa. This bracket has on its face central transverse flutings, at each side of which is a non-fluted surface.

PIN HOLDER.—Edward H. Ellis, Pasadena, Cal. In a saucer-shaped tray is fixed a cup-like cushion holder in which is held a convex cushion, surrounded at its base by an ornamental band.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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HENDRICKS' ARCHITECT'S AND BUILDER'S GUIDE AND CONTRACTOR'S DIRECTORY OF AMERICA FOR BUILDERS, CONTRACTORS, MANUFACTURERS AND DEALERS IN ALL KINDS OF BUILDING SUPPLIES. For the years 1894–95. New York: Published annually by Samuel E. Hendricks Company. Pp. xxx, 709. Price $5.

The title of this book sufficiently describes its contents. It is enough for us to say that now it covers the entire United States and presents a very long list of those concerned in the architect's profession and in the building trade.

TWO YEARS' WORK IN AN ARCHITECT'S OFFICE. By Manly N. Cutter. Suburban. New York: A. L. Chatterton & Company. 1894. Pp. 204. Price $6.

This very attractive work contains a number of architectural designs with short descriptions and specifications referring to country and to suburban houses. The preface, which is short, contains a quantity of good sense and gives points for building which, if carried out, would inevitably result in good work.

THE MINOR TACTICS OF CHESS. A treatise on the development of the forces in obedience to strategic principle. By Franklin K. Young and Edwin C. Howell. Boston: Roberts Brothers. 1894. Pp. 219. Price $1.

This little work presents an eminently attractive appearance, treating as it does of the game of chess from the tactical standpoint, not by the method of giving merely sample games, gambits and openings. It is illustrated as required and possesses an index. Its treatment of the subject of the single move as altering the entire disposition of all the forces on the board, all of them being potential and active, is excellently put.

LETTERING OF WORKING DRAWINGS. By J. C. L. Fish. New York: D. Van Nostrand Company. 1894. 13 plates. Price $1.

This eminently useful work is in the direction of obtaining a species of standard of lettering for working drawings. So much depends on the lettering that the man who can draw well but letters poorly cannot rank at all as an accomplished draughtsman. To many the obtaining of skill in lettering is so difficult that they have a special man letter their drawings. This volume is intended to aid draughtsmen to perform this important detail.

QUALITATIVE CHEMICAL ANALYSIS OF INORGANIC SUBSTANCES. As practiced in Georgetown College, D. C. New York, Cincinnati, Chicago: American Book Company. 1894. Pp. 61. Price $1.50.

We would like very much to give more space to the review of this work than we possibly can. It consists of an abstract in tabular or abbreviated form of what is to a great extent the Fresenius separation. In places it seems not very clear, as where, page 7, it directs the filtrate from the ammonio-magnesium phosphate precipitate to be tested for sodium. This, however, is an inadvertence, because, as the author depends on the spectroscope for the recognition of the alkali metals, they can be tested for them without removing the magnesium. As Table I. now reads, sodium is to be tested for in the filtrate from the magnesium precipitate, which filtrate inevitably contains sodium from the precipitant. It is in Table I. that the confusion occurs, but it is made clear in Table VIII. what process the author wishes to adopt. Nickel and copper are separated by the bromide test. Aluminum, chromium and iron are separated by the fusion process, with sodium carbonate and potassium nitrate. We have given some little space to this book, as Georgetown College has long been recognized as one of the leaders in science, and we are glad to see in the present work an indication of the development of a full analytical course in chemistry. We warmly recommend it as a text book for use on the laboratory table.

AIDS TO ENGINEERS' EXAMINATIONS. Prepared for applicants of all grades, with questions and answers. A summary of the principles and practice of steam engineering. By N. Hawkins. New York: Theo. Audel & Co. 1894. Pp. 206. Price $2.

This is one of the frequent catechisms published, there seeming be a disposition on the part of many authors to believe that practical engineers require a treatment of their subjects by question and answer, and the large circulation which many of these catechisms have received goes far to prove the correctness of this idea. Steam and electrical engineering are covered in this work, which is very nicely got up in rather a showy style of red binding, with a box to hold it.

UNDER THE CORSICAN. By Emily Howland Hoppin, author of "From Out of the Past," etc. New York: J. Selwin Tait & Sons. Pp. 333. Price $1.

SCIENTIFIC AMERICAN BUILDING EDITION.

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2. A residence at East Orange, N. J., recently completed for Geo. R. Howe, Esq. Two perspective elevations and floor plans. A pleasing design. Mr. Jas. H. Lindsley, architect, Newark, N. J.
3. A cottage at Glen Summit, Pa., erected for H. H. Harvey, Esq. Two perspective elevations and floor plans. A handsome summer cottage with some novel architectural features. Messrs. Neuer & Darcy, architects, Wilkesbarre, Pa.
4. A residence at Forest Park, Springfield, Mass. Two perspective elevations and floor plans. A combination of the Colonial style with French chateau features. Mr. Louis F. Newman, architect, Springfield, Mass.
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6. A picturesque and well appointed residence erected for the late E. E. Denniston, Esq., at School Lane, Pa. Cost complete $22,000. Perspective elevation and floor plans. Mr. Geo. T. Pearson, architect, Philadelphia, Pa.
7. A residence at Nutley, N. J., recently erected at a cost of $5,800. Perspective elevation and floor plans. Mr. E. R. Tilton, architect and designer, New York City.
8. A cottage in the Colonial style at Southampton, L. I. Two perspectives and floor plans. Mr. C. H. Skidmore, architect.
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12. A cottage in the Colonial style at Cushing's Island, Me., erected for Francis Cushing, Esq. Two perspective elevations and floor plans. Cost complete $2,000. Mr. John C. Stevens, architect, Portland, Me. A unique and picturesque design for a model summer home.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
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(6400) C. T. W. asks: What is meant by the gearing on safety bicycles, and what effect being geared high or geared low has on the running of a wheel? A. Multiply the stated gearing by 3 1-7, and it will give the approximate distance the bicycle will go for one revolution of the crank. The higher the gear, the harder is the bicycle to drive, but high gearing gives speed within certain limits. The figures of gearing express the size of wheel equivalent to the rear wheel as geared.

(6401) A. C. W. asks: Can you inform me through your answers to correspondents how to prepare gray iron castings for tinning, so that they can be coated with tin the same day, the usual process being to water tumble the castings 3 or 4 days? Also give me a way of coating the castings with a cheaper finish, as by mixture of lead or other substances with the tin. A. The gray iron castings may be quickly tinned by following the instructions in the section on tinning in "Scientific American Cyclopedia of Receipts," and then treating to a dip in a solution of sal-ammoniac in water, when the articles may be dipped in the melted tin bath, or a mixture of tin and lead as used for tinner's solder, or equal parts of tin and lead. A cheaper method is the galvanizing or coating with zinc, which is fully described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 176.

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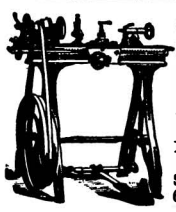

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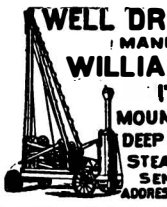

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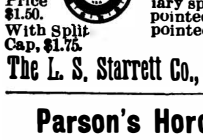

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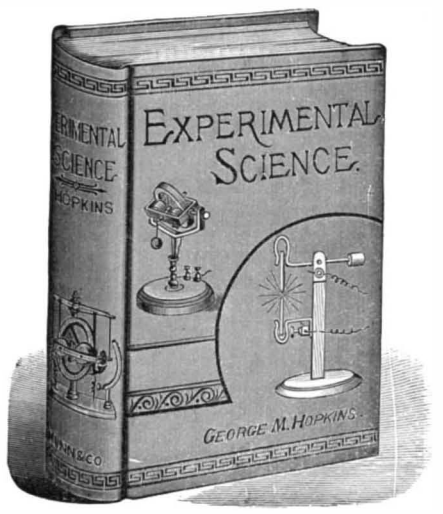

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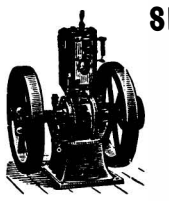

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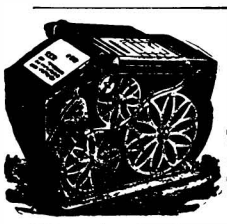

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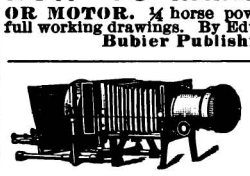

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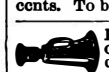

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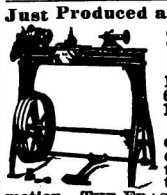

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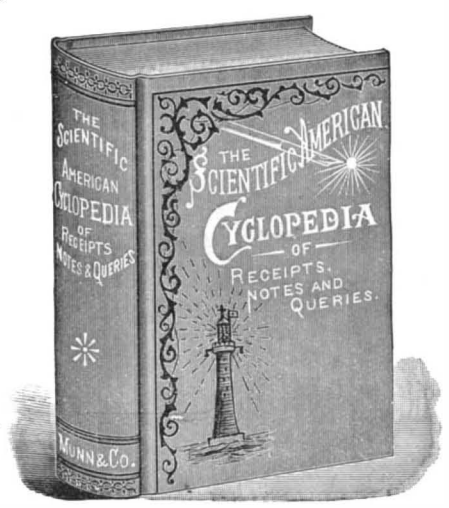

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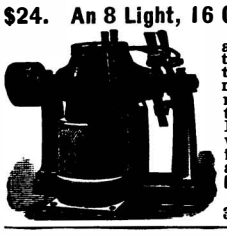

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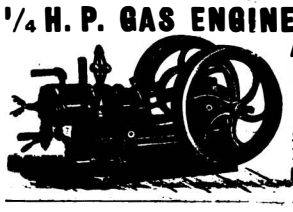

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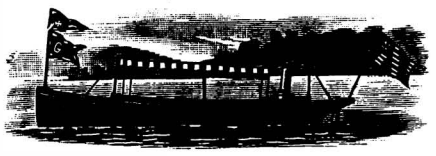

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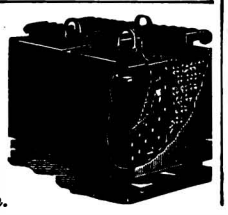

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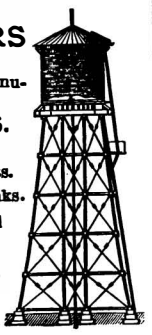

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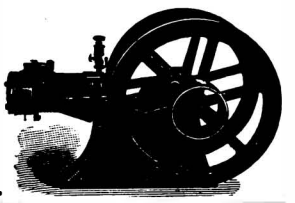

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